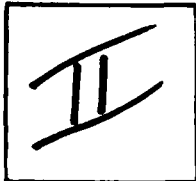


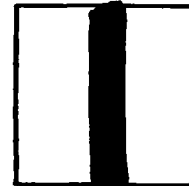
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DETAILED ANALYSIS PLAN FOR VALIDATION OF CLOSE AIR SUPPORT (CAS) PHASE II RESULTS

JUNE 1974

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ACKNOWLEDGEMENT

United States Readiness Command acknowledges the coordination and assistance of Atlantic Command and the assistance of representatives from United States Army Forces Readiness Command, United States Air Force Forces Readiness Command, Amphibious Forces Atlantic, Fleet Marine Forces Atlantic, and the United States Army Training and Doctrine Command.

Component representatives provided the necessary expertise required to fully develop this Detailed Analysis Plan. Although the Commands listed above contributed valuable inputs to the Detailed Analysis Plan, it should not be inferred that they necessarily endorse all aspects of it.

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CHAPTER 1

INTRODUCTION

1. **PURPOSE.** The purpose of the Detailed Analysis Plan (DAP) is to specifically define the test design and evaluation methodology that will be utilized in data collection and analysis.

2. **GENERAL.**

a. The Close Air Support (CAS) Validation Program is designed to reduce the uncertainties in the CAS command and control portion of the Joint Staff Task Force (JSTF) CAS Study Phase II report. The Detailed Test Plan (DTP), as approved by JCS in December 1973, contains guidance for the conduct of the Program.

b. During preparation of the Detailed Test Plan, the need to develop a Detailed Analysis Plan (DAP) was recognized to further assist Sponsoring Commands in accommodating validation requirements in the selected exercises. JCS concurred and directed that "..... in preparation of the DAP, USREDCOM, in coordination with LANTCOM, must refine to the degree possible all important factors concerning test design, data sampling, collection techniques, reduction methods, data analysis, and data presentation." Additionally, JCS directed that the "measures of effectiveness included in the Data Collection Plan, Test Plan Concept, and Detailed Test Plan should be re-examined for applicability and inclusion in the DAP.

c. The DAP identifies the analysis approach, test design, measures of effectiveness, and analysis methodology to be used in addressing ten of the eleven CAS Validation Objectives specified by JCS (ANNEX A). (One objective, number five, will be addressed separately by the Services directly to JCS.)

d. The CAS Validation Program will address the objectives as completely as possible with empirical data from exercises. Quantitative data will constitute the primary program data base.

e. Qualitative data concerning the conduct of the exercises will also be gathered by the field data collectors and analyzed to provide a context for interpretation of quantitative results. The command sponsoring the exercise will provide subjective comments to fill voids in information in specific areas on specific objectives at the conclusion of each exercise. The subjective comments will be used for subjective treatment of objectives and JCS directed areas. As directed by the JCS, the "Services and Commanders of the Unified Commands will submit subjective comments on the test objectives." Airborne survivability will be addressed in subjective comments submitted by Commanders of the unified commands and in the intelligence play of the exercise. The apportionment and allocation of CAS air assets as they pertain to the Army/Air Force command and control system for CAS will be examined in a subjective manner. Subjective comments are discussed in ANNEX B.

f. Subjective comments will not be used to modify or alter the quantitative data.

g. In general, peacetime exercises must meet a multiplicity of objectives to achieve maximum training of forces in the time allocated. Accordingly, commanders are provided a large measure of operational flexibility in the accomplishment of their assigned tasks. The plan of analysis is based on the assumption that each exercise will be controlled to the extent necessary to provide a range of specified CAS operational conditions/environments and an adequate number of immediate CAS missions for each condition. In the preparation of scenarios for the selected training exercises, the CAS Validation Program inputs are structured to preclude extraordinary preparations that would detract from the training objectives.

h. An estimate of the operational conditions and numbers of missions required to achieve the CAS Validation objectives have been incorporated in the CAS Exercise program test design. The test design is a compromise between several somewhat conflicting requirements: The CAS data required to achieve the objectives; the "piggy-back" requirement on training exercises; and the JCS directed requirement that the CAS Validation Program not interfere with training objectives. These requirements, coupled with other limitations inherent in training exercises, limit the extent to which objectives can be addressed. Experience indicates however that test design implementation is possible with minimal interference with exercise training objectives. In fact it may enhance, rather than detract from, CAS training.

i. Successful implementation of the test design will require continuous face-to-face liaison, coordination, and cooperation between members of the Joint CAS Validation Headquarters and personnel directly responsible for planning and conducting the exercise.

j. The ten CAS Validation objectives differ in nature and degree to which they may be satisfied through the CAS Validation Program. It should be recognized that response times alone will not constitute a completely valid overall judgment of the CAS systems. This is because of the artificialities that are present in any exercise and other important factors associated with the effectiveness of the close air support systems.

3. SCOPE.

a. The scope of the plan of analysis includes:

- (1) A test design and guidance for CAS scenario preparation.
- (2) The principles to be employed in data analysis and presentation of results.
- (3) Data reduction procedures, and
- (4) Data requirements and data form questions to be utilized in the collection effort.

b. The test design specifies the range of exercise conditions to be incorporated in scenarios, the number of immediate CAS missions required, and the paths of the three command and control networks for CAS of primary interest for purposes of analysis. Guidance is provided for implementation of the test design during exercise scenario preparation. The test design, in effect, establishes and limits the scope of quantitative analysis.

c. The Data Analysis Plan focuses on the performance of the three command and control networks for CAS as a function of the exercise conditions and network paths specified in the test design. The Data Analysis Plan does not attempt to extrapolate the estimated performance of the three networks to operational environments or conditions not included in exercises. Where possible, performance comparisons will be made with the JSTF CAS Phase II Study results.

d. Data reduction procedures are divided into two phases. The first phase includes data reduction procedures at the field exercise site including reviewing, sorting and tabulating. The second phase, to be conducted at USREDCOM, includes procedures to establish and maintain a data base and provide outputs as required.

e. Descriptive event models are derived for each of the three command and control networks for CAS to establish the data required to achieve the CAS validation objectives and to specify the locations of field data collection sites. Each event is defined to facilitate the formulation of data form questions. Subdivisions of elapsed times are compatible with those given in the JSTF CAS Study Phase.

f. A glossary of terms is included in ANNEX H. This glossary contains both joint terms and terms developed specifically in the CAS Validation Program. The newly defined terms are not jointly agreed to by the Services and do not constitute a precedent for definition change. These new terms, along with Service unique terms, will be identified as such in the glossary.

4. REFINEMENTS IN METHODOLOGY. During the development of the Detailed Analysis Plan, the quantitative aspects of analysis addressed in the Data Collection Plan, the Test Plan Concept, and the Detailed Test Plan were re-examined. It became apparent that specific areas needed further refinement in order to conduct the analysis required. These refinements are:

a. Request Phase Response Times. Additional analysis of the three command and control networks for CAS indicates that it is not realistic to select a common starting point for measurement of elapsed times for the Request Phase of a CAS mission based on a single echelon of command, i.e., battalion, for all networks for CAS. For the Army/Air Force network, the start time is when the Battalion Tactical Air Control Party acknowledges a request for immediate CAS. For the Army Attack Helicopter Command and Control network, emphasis will be placed on gathering that data directly comparable to the paths through the attack helicopter command and control network identified in the JSTF CAS Study Phase II. Data will be collected on all attack helicopter missions including aerial field artillery requested at company level which are coordinated/integrated at Battalion level or higher. For the Army attack helicopter network, the start time is when a command/troop acknowledges a request or identifies a requirement for immediate CAS. For the Navy/Marine Corps network, the start time for the Request Phase is the time the Forward Air Controller (FAC) initiates a Tactical Air Request (TAR).

b. Data Forms. Differences among the functions performed at elements or agencies within the three command and control networks for CAS necessitated the development of unique sets of data form questions for each of the networks for CAS. The revised data form questions for the three networks are presented in ANNEX C.

c. Mission Sample Size Requirements. Additional study of estimates contained in the Detailed Test Plan for the number of immediate CAS missions required per exercise condition indicates that they are too low to provide a valid statistical base. Revised estimates are given in Chapter III.

CHAPTER II

ANALYSIS APPROACH

1. GENERAL. The purpose of this chapter is to provide a context for the subject matter presented in the following chapters and describe the approach employed in developing the plan of analysis. Knowledge of the contents of the Data Collection Plan, the Test Plan Concept, and the Detailed Test Plan is essential.

2. CAS VALIDATION METHODOLOGY DEVELOPMENT.

a. The plan of analysis presented herein is a refinement and extension of procedures and methodology described in the Data Collection Plan, the Test Plan Concept, and the Detailed Test Plan. Elements of these plans affecting quantitative analysis procedures, and application of subjective comments, were reviewed and refined as required. Other elements of information required in a plan of analysis and not treated in the above documents (e.g., use of quantitative data to address objectives) were developed and are included in this document.

b. The Data Collection Plan addressed the kinds of information essential to the subsequent development of the Test Plan Concept and the Detailed Test Plan. The kinds of information developed are: (1) Measures of effectiveness; (2) data requirements; and (3) data collection methods and instrumentation. The Test Plan Concept set forth procedures for collection of quantitative data and identified data elements to be collected during Service and joint exercises. Exercises to be "piggybacked" for CAS data collection were also identified. The Detailed Test Plan addressed the extent to which the CAS Validation Objectives can be achieved and discussed quantitative analysis requirements.

c. Past development of CAS methodology concerning analysis of exercise results was fragmented and no one document or series of documents addresses all of the aspects of analysis required for implementation. This situation was recognized during development of the Detailed Test Plan resulting in a decision to develop the Detailed Analysis Plan.

d. An intimate relationship exists between the CAS Validation Objectives, measures of effectiveness, test design, method of analysis, data reduction and data form questions. Because these items of information are not independent, they must be properly interrelated to insure that the exercise program objectives can be achieved. Thus, in developing the Detailed Analysis Plan, it was necessary to review and refine the above items of information contained in previously published plans to insure consistency.

3. CONCEPT OF ANALYSIS.

a. Four items of information essential in developing the plan of analysis for the CAS Validation Program are:

- (1) CAS Validation Objectives.
- (2) Measure of effectiveness.
- (3) Detailed descriptions of the three command and control networks for CAS.
- (4) Operational and environmental conditions.

b. Review of the CAS Validation Objectives, and other guidance, resulted in the selection of the following measures of effectiveness for assessing the performance of the three command and control networks for CAS.

- (1) Immediate CAS mission response time.
- (2) Success or failure to perform essential functions.

c. To address the measures of effectiveness, the following quantitative measures of analysis will be used.

(1) Immediate CAS mission response time as a function of operational, environmental, and CAS network conditions to include a breakdown of all elapsed times in the Request and Execution Phases of a mission. CAS network conditions refer to levels of damage to elements or agencies within the command and control networks for CAS.

(2) Frequency of delays observed in the performance of CAS command and control functions.

(3) Frequency of delays caused by inability to perform CAS command and control functions to include mission aborts.

(4) Frequency of occurrence of request disapprovals and cancellations.

(5) Distribution of causes, by network location, of delays, disapprovals, and cancellations.

d. The first measure of analysis was selected to satisfy CAS Validation Objective One and the remaining measures are required to satisfy objectives two through eleven, except five (Training Requirements). CAS Validation Objective five will be addressed independently by the Services.

e. Detailed operational breakdowns of the three command and control networks for CAS, described in terms of event models, are required to establish immediate CAS mission data collection requirements.

f. In addition to functional command and control areas, the CAS Validation Objectives specify operational, environmental, and CAS network conditions which may improve or degrade the performance of the command and control networks for CAS. The scope of conditions explicitly stated or implied in the CAS Validation Objectives was used to derive a set of selected exercise and CAS network conditions for purposes of analysis of the performance of the three command and control networks for CAS.

g. As a result of the structure of the CAS Validation Objectives, the general concept of analysis is to determine immediate CAS mission response times, associated frequencies and causes of delays, and mission disapprovals and cancellations, as a function of selected exercise and CAS network conditions. This means that Objectives two through eleven, except five, will be evaluated with respect to Objective one.

h. Quantitative results will be compared with those published in the JSTF CAS Phase II Report. In areas where quantitative results are not fully available, applicable subjective comments from Services and Unified Commands will be used to augment the comparison.

4. DEVELOPMENT APPROACH.

a. The range of exercise and CAS network conditions required to assess the performance of the three networks for CAS is so broad that it is not possible to address all objectives by means of scheduled Service and joint exercises. In addition, operational constraints imposed by exercise locations, size, level of air activity, and safety requirements preclude achieving quantitative results for all CAS Validation Objectives.

b. In accordance with JCS guidance, the approach employed to select exercise and CAS network conditions for inclusion in the test design was based on minimizing effects on exercise training objectives. However, control measures over

and above those normally employed in training exercises and scenario modifications may be required to accommodate the CAS Validation Program.

c. Objectives that cannot be satisfied by quantitative data obtained from exercises will be addressed through subjective comments. Qualitative information on the conduct of CAS exercises and the manner in which the CAS functions are performed will be collected, analyzed and used for interpretation of quantitative results.

d. Based upon the above considerations and the concept of analysis discussed in Paragraph 3 of this Chapter, the approach employed in developing the plan of analysis is as follows:

- (1) Selection of exercise and CAS network conditions to be recorded during the conduct of an exercise.
- (2) Selection of exercise and CAS network conditions to be included and planned for in exercise scenario development, and controlled during the conduct of an exercise. These conditions are referred to as Base Case and deviations from Base Case conditions.
- (3) Establishment of a Base Case set of exercise and CAS network conditions. This is a set of conditions which neither improve nor degrade the performance of the three command and control networks for CAS.
- (4) Identification of deviations from Base Case conditions. These are exercise and CAS network conditions which may improve or degrade the performance of the three command and control networks for CAS.
- (5) Establishment of a test design and CAS network sampling plan.
- (6) Estimation of immediate CAS mission sample size requirements.
- (7) Provision for guidance for CAS exercise scenario development.
- (8) Construction of critical event models for the three command and control networks for CAS for the purpose of establishing immediate CAS mission data collection requirements.
- (9) Development of mission data form questions.
- (10) Development of procedures for analysis and presentation of results.
- (11) Development of data reduction procedures.
- (12) Development of detailed analysis methodology.

CHAPTER III
CAS TEST DESIGN

1. GENERAL.

a. This chapter presents (1) the test design for the exercise schedule within the CAS Validation Program; (2) requirements for subjective comments; (3) preliminary estimates of the number of immediate CAS missions required for analysis; (4) the CAS network sampling plan for each of the three command and control networks for CAS; and (5) guidance for implementation of CAS requirements in training exercise scenarios. Specification of these items of information for inclusion in planning and execution of the CAS Validation Program is required to insure that the Program will satisfy the stated CAS Validation Objectives (Annex A).

b. The test design specifies the CAS exercise conditions (operational and environmental) and network conditions (levels of element or agency damage) that should be planned for and incorporated in scenarios to provide the quantitative data required to address the CAS Validation Objectives. In addition, it specifies the manner in which these conditions should be varied during the conduct of an exercise. The test design is the keystone of the exercise program and specifies how objectives are to be satisfied. It dictates CAS scenario requirements and procedures for data analysis.

c. Selection of the number and types of exercise and CAS conditions to be included in the test design was a compromise between several somewhat conflicting requirements which are: (1) the exercise and CAS network conditions required to generate data to achieve the CAS Validation Objectives; (2) the "piggyback" requirement on scheduled joint exercises; and (3) the JCS-directed requirement that the CAS Validation Program not interfere with exercise training objectives. To meet these requirements, the numbers and types of CAS exercise conditions specified in the test design and mission sample size requirements were held to a minimum.

d. In addition to required exercise conditions, a minimum number of immediate CAS missions must be conducted to insure the generation of an adequate sample size of mission related data to address the CAS Validation Objectives. Immediate CAS mission sample sizes are given as a function of exercise conditions and network paths for each of the three command and control networks for CAS. These network paths are the sequence in which the elements or agencies are employed in the request and execution phase of an immediate CAS request.

e. CAS exercise scenario content and sequencing and control of exercise events are the significant factors influencing the accomplishment of the CAS Validation Objectives. Exercise scenarios must be written to accommodate immediate CAS mission sample size requirements as a function of selected exercise conditions and network paths. To assist in the planning and preparation of the CAS portion of exercise scenarios, a set of guidelines is given in Annex D.

f. Because of the broad scope of the JCS Validation Objectives and the limited degree of exercise control specified in the test design, it is anticipated that the CAS Exercise Program results may only identify broad problem areas in the performance of the three command and control networks for CAS. For example, exercise results may indicate communications deficiencies in the Request Phase of a CAS mission, but may not be able to pinpoint the deficiencies to a degree such that immediate corrective action could be initiated without further study.

2. DATA AND INFORMATION REQUIREMENTS.

a. Types of Data and Information. The three major categories of data and information required to achieve the objectives of the CAS Validation Program are depicted in Figure 3-1. In order to achieve the CAS Validation Objectives, primary emphasis is on the collection of quantitative data from scheduled joint training exercises. Qualitative data on exercise limitations and the manner in which network elements or agencies perform CAS functions will also be collected during exercises. This data will be analyzed and used to provide a context for interpretation of quantitative results. Subjective comments refer to statements submitted by Services, Unified Commands, and Sponsoring Commands required to clarify and augment quantitative data to address the CAS Validation Objectives.

b. Quantitative Data.

(1) Quantitative data requirements are incorporated in a test design. The test design identifies CAS controlled and uncontrolled factors. Controlled factors refer to stated CAS exercise and network conditions that should be planned for and incorporated in scenarios. For purposes of analysis, controlled CAS exercise and network conditions are divided into Base Case conditions and deviations from Base Case conditions.

(2) Uncontrolled factors refer to data, descriptive of the performance of the three command and control networks for CAS. These include:

(a) Immediate CAS mission performance data (e.g., time to perform a CAS function, etc.).

(b) Network path utilized (e.g., CAS request filled by DASC controlled air assets, etc.).

(c) CAS mission variables (e.g., mission of supported unit, etc.).

(d) Techniques and procedures.

Data will be continuously recorded on the first three data items but not the last. However, inconsistencies among exercise conditions and the techniques and procedures will be recorded if they occur.

(3) It should be noted that some of the above items of data are qualitative and are included in the broad category of quantitative data to facilitate discussion about data and information requirements. Detailed discussions on quantitative data are in Annex E.

c. Qualitative Data. Estimates of measures of effectiveness of the three command and control networks are subject to uncertainties because of exercise limitations (e.g., simulated ordnance drops, FAA restrictions, etc.). These types of data will be collected and analyzed to provide a context for interpretation of quantitative results. Detailed discussion of these types of data are covered in Chapter IV.

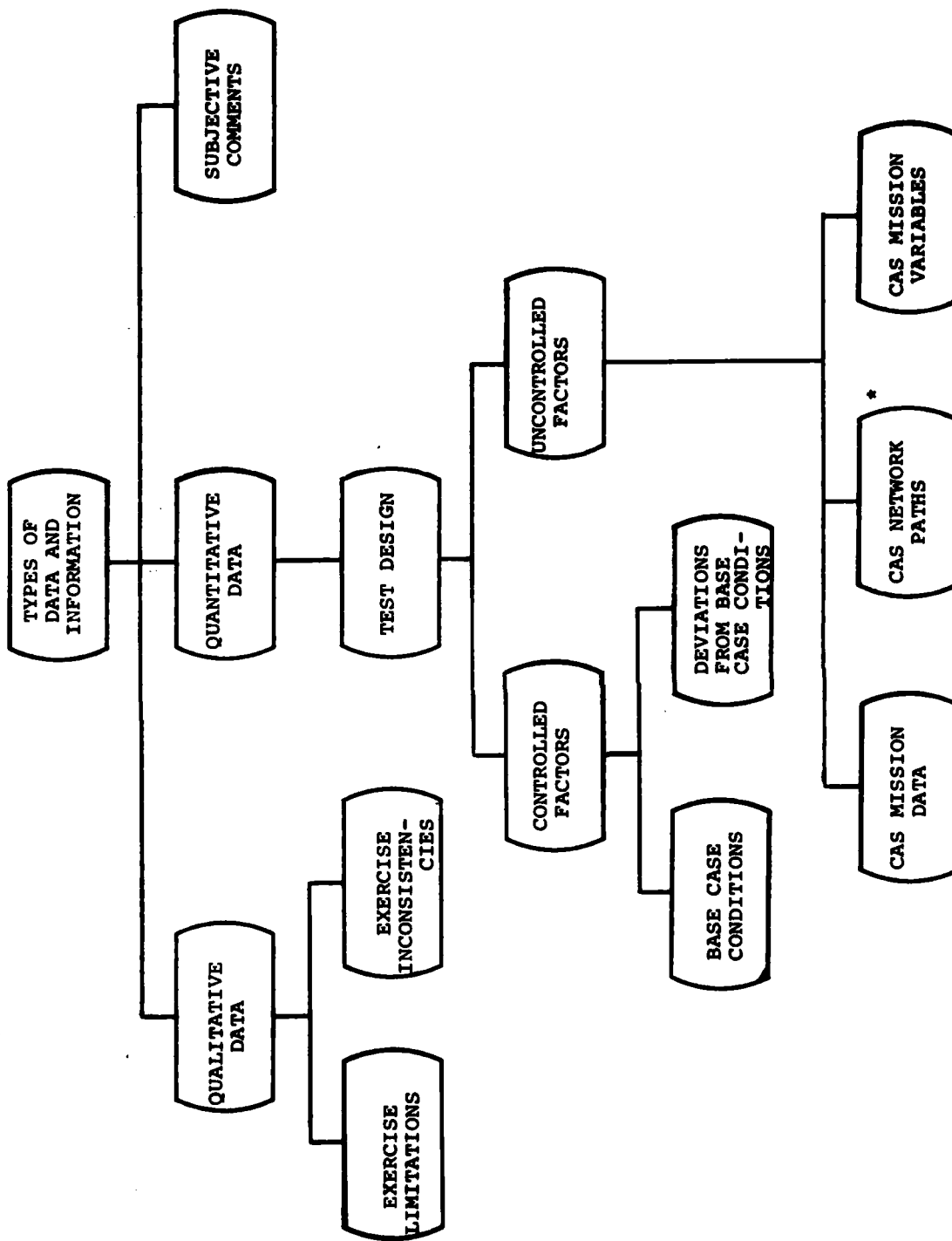
d. Subjective Comments. For the purpose of the CAS Validation Program, subjective comments have been divided into several areas. This has been done to clarify the solicited comments. Details on the subjective comments, to include submission requirements, are included in ANNEX B.

(1) Subjective comments on the test objectives.

(2) Subjective comments about each training exercise.

(3) Subjective comments on the contents of the draft final report.

(4) Subjective comments about survivability.



NOTE: *Semi-controlled

Figure 3-1. CAS Validation Program Data and Information Requirements.

(5) Subjective comments about apportionment and allocation as they pertain to the Army/Air Force command and control network for CAS.

(6) Subjective comments about specific points.

3. **TEST DESIGN.** The test design focuses on those CAS exercises and network conditions to be planned for and incorporated in exercise scenarios. The number and type of conditions selected for inclusion in scenarios was a compromise between the exercise conditions required to achieve the CAS Validation Objectives, the "piggyback" requirements on scheduled exercises, and the requirement for minimal interference with readiness training objectives. Exercise conditions that could not be achieved because of joint training exercise limitations, or because of a high probability they would interfere with training objectives, were not selected for inclusion in the test design as controlled conditions.

a. Base Case Conditions.

(1) The foundation of the test design is a set of Base Case operational, environmental and network conditions. Base Case conditions are defined as a set of conditions which neither improve nor degrade the performance of the three command and control networks for CAS. Base Case conditions provide a standard for the analysis of effects of changes in exercise conditions on the performance of the networks.

(2) Analysis of the CAS Validation Objectives resulted in the selection of ten conditions to define the Base Case. These are:

- (a) Daylight conditions.
- (b) Good weather/visibility.
- (c) No damage to network elements or agencies.
- (d) No secure voice.
- (e) Standard equipment.
- (f) Limited enemy air threat.
- (g) Limited enemy air defense threat.
- (h) Adequate intelligence.
- (i) Target poor environment.
- (j) No ECM threat.

(3) Condition (c) above implies that all nodes in the network are operational. Under condition (e), standard equipment is defined as equipments currently in the inventory. Limited enemy air threat implies minimal coordination is required to integrate immediate CAS missions with other functions (i.e., air defense, etc.). A target poor environment is defined as a condition for which the air assets available are more than adequate to satisfy requests for CAS.

b. Deviations from Base Case Conditions.

(1) Deviations from Base Case conditions selected to provide quantitative data to satisfy the CAS Validation Objectives are:

- (a) Night conditions.
- (b) Substantial enemy air threat.
- (c) Substantial enemy air defense threat.

- (d) Target rich environment.
- (e) ECM threat.
- (f) Damaged network elements or agencies.
- (g) Reduced weather/visibility.
- (h) Secure voice.
- (i) New equipment.*

(2) Conditions (b) and (c) imply a high degree of coordination is required to integrate immediate CAS missions with other functions such as air defense, interdiction, reconnaissance, etc., and to identify airspace control problems. A target rich environment is a condition for which the demand for immediate CAS must be filled on a priority basis. A target rich environment is included to provide an exercise condition for assessment of the three command and control networks for CAS under stress conditions. It is not a condition for assessment of system capacity.

c. Exercise Conditions Versus Validation Objectives.

(1) Deviations from Base Case conditions could occur in a large number of combinations during the conduct of exercises. For example, only one condition at a time could differ from the Base Case during some interval of time, or combinations of two or more conditions could differ from the Base Case during some period of time. It is clear that it is not feasible to attempt to conduct a series of exercises to account for all possible combinations of deviations from the Base Case.

(2) One approach to reduce the number of deviations from the Base Case is to consider only single condition deviations from the Base Case during scenario preparation. This approach would minimize the complexity of scenarios for CAS and simplify analysis of CAS mission related data. This test design is indicated in Table 3-1. The table indicates the exercise conditions required to satisfy given CAS Validation Objectives. For example, all exercise conditions apply to Objective 1, Secure Voice conditions apply to Objective 2, etc.

(3) No specific exercise conditions are specified for CAS Validation Objectives 4, 7, 9 and 10. The means have been provided to collect data relative to these objectives, but the degree to which the data can be used to quantitatively validate these objectives will be limited.

(4) It is important to note that all Base Case and deviations from Base Case conditions are controllable with the exception of day/night and weather conditions. The controllable conditions can be incorporated in exercise scenarios. The other two conditions will be recorded on data collection forms. Night and adverse weather may be simulated to provide deviation conditions.

(5) In addition to the exercise conditions listed in Table 3-1, there are a number of mission variables which may affect response times (i.e., type of target, terrain conditions, type of target markers, etc.). Information concerning these variables will be recorded during the conduct of an exercise and are listed in the latter part of this Chapter. However, it should be noted that the sampling plan discussed in the following sections is not designed to assure that sufficient sample sizes will be available to assess the effects of these variables on response times of CAS command and control functions.

*New items of equipment to be included in the Exercise Program will be identified at some future date.

CAS EXERCISE CONDITIONS	CAS VALIDATION OBJECTIVES										
	RESPONSE TIMES	COMMUNICATION	INTEGRATION	SYSTEM CAPACITY	TRAINING	DEGRADATION ENVIRONMENT	TARGET ACQUISITION	DEGRADATION DAMAGED ELEMENTS	INTELLIGENCE	COMPATIBILITY/INTEROPERABILITY	NEW EQUIPMENT
	1	2	3	4	5	6	7	8	9	10	11
BASE CASE	X										
NIGHT	X					X					
REDUCED WX/VIS	X					X					
DAMAGED ELEMENTS	X							X			
SECURE VOICE	X	X									
NEW EQUIPMENT	X										X
AIR THREAT	X		X								
AAW THREAT	X										
TARGET RICH	X										
ECM THREAT	X	X									

TABLE 3-1
Exercise Conditions Designed
to
Satisfy CAS Validation Objectives

4. Mission Sample Size Requirements.

a. Statistical Uncertainty.

(1) Inferences about the performance of the networks are subject to three types of uncertainties. These are:

(a) Uncertainties attributable to exercise limitations (e.g., live ordnance drops, etc.).

(b) Uncertainties attributable to observed inconsistencies between exercise conditions and the application of CAS techniques and procedures.

(c) Statistical uncertainty attributable to limited sample sizes of immediate CAS mission related data. This section addresses the degree of statistical uncertainty associated with estimation of the measures of effectiveness.

(2) The types of measures of analysis are:

(a) Immediate CAS mission response times.

(b) Frequency distributions of delays, disapprovals and cancellations.

(c) Frequency distributions of causes of delays, disapprovals and cancellations.

(3) The statistical accuracy with which the above measures can be estimated from exercise data is dependent upon the number of missions conducted for given exercise conditions and the rates of occurrences of delays, disapprovals and cancellations. These rates will vary according to exercise conditions

b. Response Time Measurements.

(1) The degree of uncertainty in estimating response times can be described quantitatively by the method of confidence intervals as illustrated in Figures 3-2 and 3-3. Computation of these intervals is based on the assumption that the underlying distribution of response times are exponential. Analysis of mission response times from exercise data indicates that this is an adequate assumption for planning purposes.

(2) Figure 3-2 is a plot of two-sided 90% confidence intervals for the true mean response time (θ) as a function of the number of observed CAS missions, where the estimated mean is denoted by θ^* . The limit curves indicate a high degree of uncertainty in estimation of mean response times for sample sizes of less than ten missions. For example, if a mean response time of 20 minutes ($\theta^* = 20$) is estimated from a sample size of six missions ($N = 6$), then the true mean θ lies between the limits of 10 and 50 minutes ($10 < \theta < 50$) with probability .90. If the same estimates were obtained for a sample size of 20 missions, the true means would lie between the limits of 16 and 30 minutes ($16 < \theta < 30$).

(3) Figure 3-3 is a plot of two-sided 95% confidence intervals for the true minimum response time (t) as a function of the number of observed missions, where t_1 denotes the observed minimum response time. Again, for sample sizes of less than ten, the intervals are relatively wide indicating a high degree of uncertainty as to the true value of the minimum time. Assuming the minimum time is estimated to be ten minutes ($t_1 = 10$) for a sample size of ten missions ($N = 10$), then the true minimum time (t) would be between the limits of six and 10 minutes ($6 < t < 10$) with probability .95. If the same minimum time estimate was obtained for a sample size of 18 missions, the true mean would be between the limits of 8 and 10 minutes ($8 < t < 10$) indicating a high degree of accuracy.

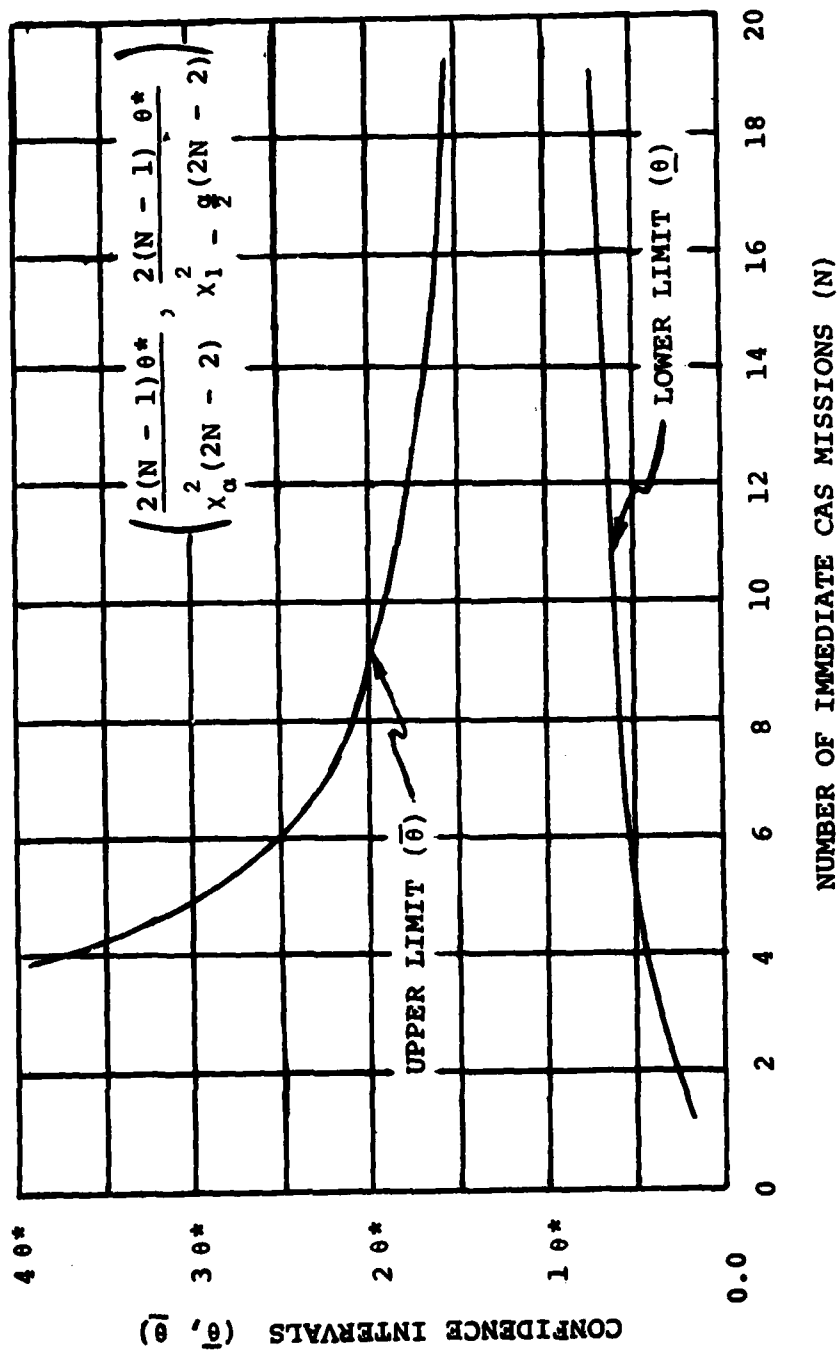


Figure 3-2. Two-Sided 90% Confidence Intervals for the Mean Mission Response Time.

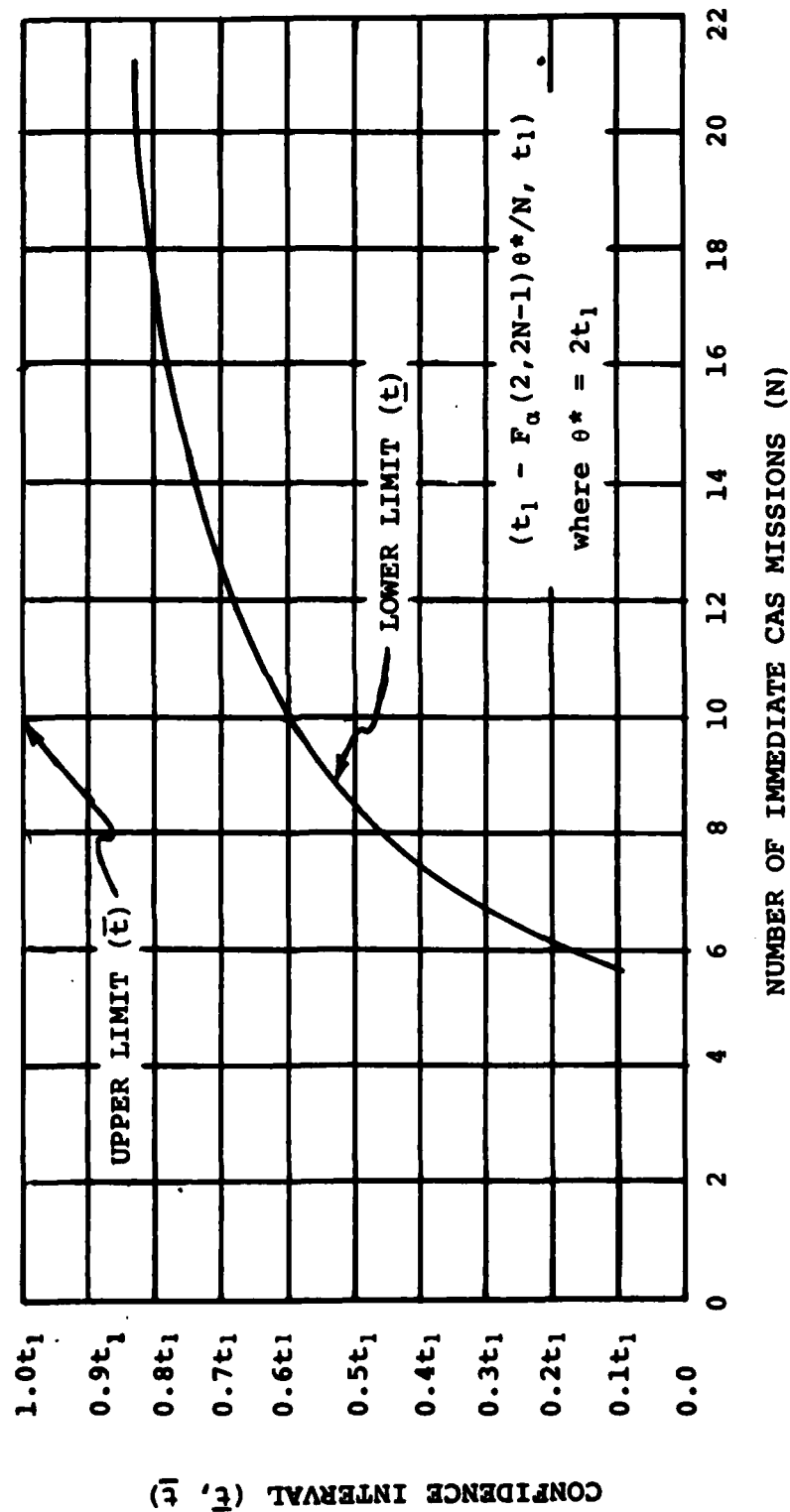


Figure 3-3. Two-Sided 95% Confidence Intervals for the Minimum Mission Response Time.

c. Frequency Measurements.

(1) Frequency measurements (number per mission) of delays, disapprovals and cancellations will be used to draw inferences about the performance of the three command and control networks for CAS relative to CAS Validation Objectives 2 thru 11, except Objective 5. The number of missions required to estimate the above frequencies is dependent upon their rate of occurrence (number per unit time). These rates will vary from exercise condition to exercise condition and, at the current time, are unknown.

(2) The frequency of occurrence of types, or causes of delays disapprovals and cancellations (e.g., inability to obtain fire support coordination, etc.), is governed to a large extent by the types of exercise conditions incorporated in scenarios. Therefore, the assessment of objectives 2 thru 11, except Objective 5, is highly dependent upon the degree of implementation of the CAS test design in the exercise schedule of the CAS Validation Program. The degree of success in implementing the test design will be evaluated from exercise to exercise.

(3) The dominant factor in establishing mission sample size requirements are the rates of occurrence of delays, disapprovals and cancellations. These rates, and hence mission sample size requirements, are a function of exercise conditions. Mission sample size requirements for acceptable frequency estimations will, more than likely, be higher than those required for estimation of response times (Objective 1). Data derived from the first two exercises in the CAS Validation Program (BRAVE CREW and EXPRESS CHARGER) will be used to derive mission sample size requirements for estimation of frequencies.

(4) The minimum number of immediate CAS missions required to estimate response times are ten per alert posture (i.e., air alert, ground alert, etc.), for a given set of exercise conditions. Fifteen to twenty missions are highly desirable.

5. NETWORK SAMPLING PLAN.

a. For the Test Design illustrated in Table 3-1, it is not possible with the current schedule of exercises to obtain sufficient CAS mission related data for Base Case conditions and deviations from Base Case conditions, and for all paths through the three command and control networks for CAS. Therefore, the following scheme was developed to provide an adequate data base for analysis.

b. A minimum of ten complete immediate CAS missions be generated per alert posture for the principal paths of the three command and control networks for CAS for Base Case conditions. Principal paths are defined in the next section.

c. For exercise conditions which are deviations from Base Case conditions, a minimum sample size of 20 immediate CAS missions are required. Principle paths should be utilized. However, alert postures utilized would be governed by exercise conditions.

d. Guidance for implementation of the above requirements is discussed in Annex D.

CHAPTER IV

ANALYSIS PROCEDURES

1. GENERAL.

a. This chapter identifies the procedures to be employed in the analysis of the quantitative and qualitative data and the inclusion of subjective comments in addressing the CAS Validation Objectives. An overview of the analysis is presented in Figure 4-1.

b. The primary data source for quantitative and qualitative data will be manual data collection forms. A voice recording system (VRS) and a range measurement system (RMS-2) will be used to augment the manually collected data. The VRS will be used to fill voids in the data base and/or resolve conflicting data elements. More details on the procedures for integrating the VRS data into the manual data base are included in paragraph 4. The RMS-2 will be used on a limited number of the scheduled training exercises. When employed, data collected may be used to augment the analysis of the terminal control of immediate CAS missions, e.g., tactics and target identification where practicable. Operationally experienced personnel will serve as data collectors at the various nodes in the system. The data elements collected will be discussed in detail in paragraph 4. Procedures for collection of the completed forms is outlined in Annex C.

c. A management control technique for scenario preparation, outlined in ANNEX D, is required to adjust the scenario inputs exercise by exercise for inclusion of specific conditions not addressed in previous exercises. This technique also identifies aids for use during the conduct of an exercise. Where exercise results are not meeting the planned accomplishments, redirection may be possible. It could mean the difference between acceptable/unacceptable data for evaluation.

d. The analysis methodology is based on the assumption that the test design described in Chapter III will be used as guidance for scenario preparation and that training exercises will be controlled to the extent necessary to generate an adequate sample size of mission related data.

e. The data collected will be assembled for analysis into immediate close air support request histories. The request histories will be classified as either complete or incomplete. A detailed discussion of the classification system is contained in paragraph 5.

f. All of the CAS Validation Objectives have several common factors or measures of analysis. These measures of analysis include the various elapsed times; i.e., processing times, communications times, link times, Request Phase elapsed times, Execution Phase elapsed times, transit times, target acquisition times, etc. A frequency and cause analysis of delay, abort, disapprovals and cancellations will be conducted for each of these elapsed times.

g. The analysis methodology identifies the techniques of combining quantitative and qualitative data and is included in the dendritic diagrams of each objective. The details of the analysis methodology are included in ANNEX F.

2. SCOPE. The analysis focuses on the performance of three command and control networks for CAS as a function of the exercise conditions and network paths specified in the test design. The scope of the quantitative analysis is to determine immediate CAS mission response times, associated frequencies and causes of delays, disapprovals and cancellations, as a function of selected exercise and CAS network conditions. Effects of decisions on allocations of aircraft sorties, aircraft sortie availability, survivability of aircraft, and weapons effects are excluded from the quantitative analysis. The analysis will not attempt to extrapolate the estimated performance of the three networks to

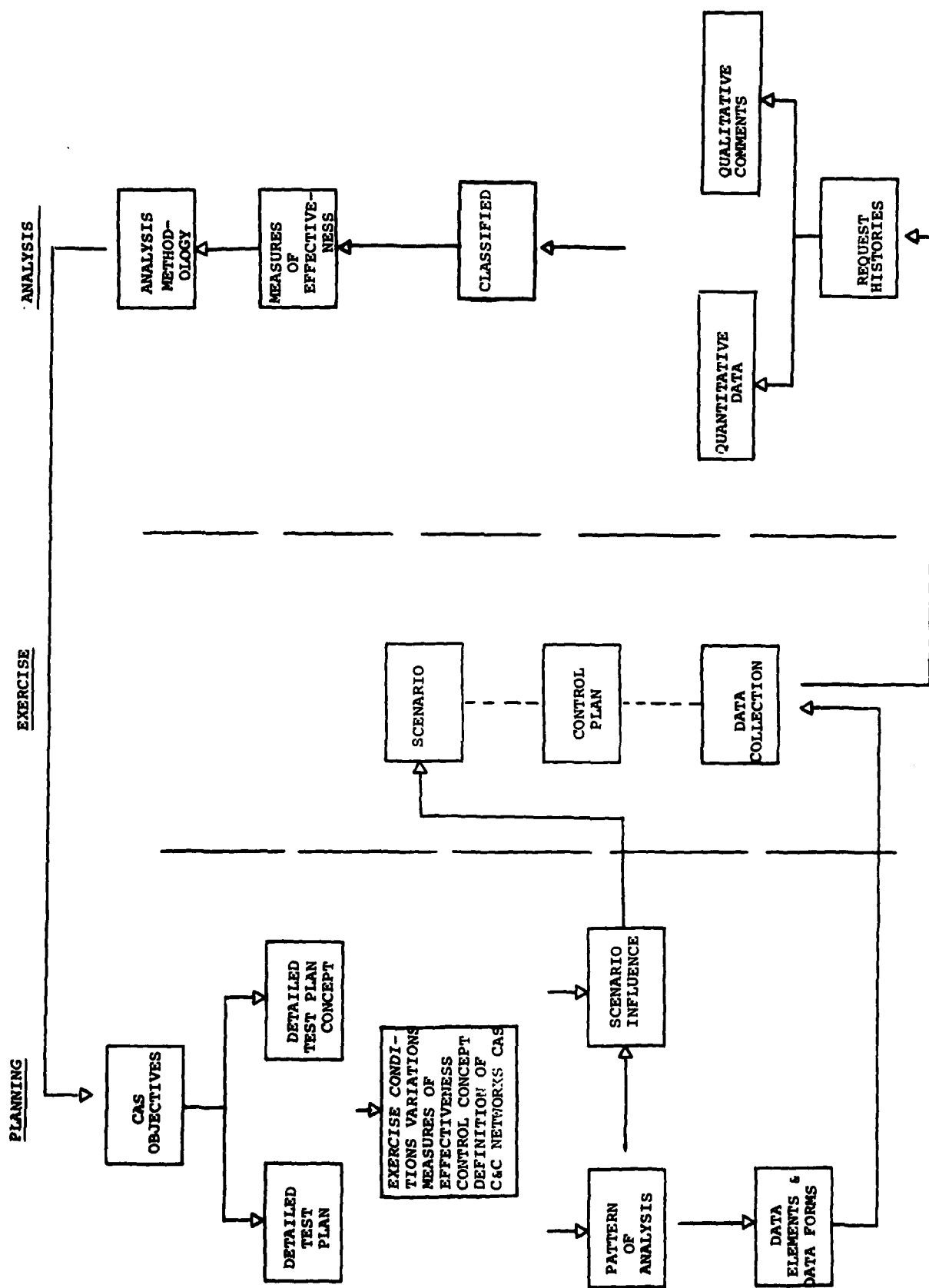


Figure 4-1. Overview of Analysis.

operational environments or conditions not included in exercises. Where possible, performance comparisons will be made with the JSTF CAS Phase II Study Results.

3. PATTERN OF ANALYSIS.

a. A pattern of analysis, logic diagram or dendritic tree is the mechanism for translating broad objectives into distinct manageable elements for evaluation. Each of the CAS evaluation objectives are refined into subobjectives, subelements, and data elements required for analysis. The level of subdivision is dependent on the complexity of the objective and the amount of quantifiable and qualitative data expected from the field exercises directly relating to the objective being analyzed. Where applicable, the pattern of analysis identifies system degradation through qualitative information and ability to perform essential functions and/or response times.

b. Certain parameters are common to each CAS Validation Objective. These have been singled out as measures of analysis. They identify in detail the subelements in the objective dendritic diagrams. The subdivision technique used for the objectives was used for the measures of analysis. The various measures are summarized below with details included in ANNEX F.

(1) For analysis purposes the response time has been subdivided into various segments identified in ANNEX E. The overall response time is a distribution of times measured for each included in the analysis sample. The distribution will include the estimate of the optimistic, most likely, and pessimistic times. When possible, a like analysis of response times will be conducted for the node-to-node link times and various aggregate times identified in ANNEX E, i.e., request phase response time, execution phase response time, etc.

(2) Node-to-node link times are the summation of the node processing time and the node-to-node communication time to the next node. The link times are computed for each link utilized in processing a given request. Where statistically feasible, the node-to-node link times for a given link will be combined to obtain a response time distribution.

(a) The processing time is the incremental time between the time of first attempt to transmit the request to the next node and the time of acknowledgment of the request at the present node. Decision time is a part of the processing time. In many cases decision time will not be a finite singular time, but integrated into the processing time. In those cases where decision time can be identified, times will be collected.

(b) The communications time is the incremental time between the time of first attempt to transmit the request to the next node and the time of acknowledgment by the next node.

(c) The response times address Objective 1. To address the remaining objectives, an analysis of system degradation is conducted through an evaluation of the frequency of delays, cancellations and disapproval combined with response times. An analysis of delay frequency by causes, interpreted with qualitative information, provides a basis for the system analysis. The response times are used to help identify the magnitude of the delay. The frequency and causes of delays will be analyzed in regard to:

- (1) CAS Validation Objectives.
- (2) CAS Validation operational and environmental conditions, and
- (3) Mission variables.

4. DATA ELEMENTS.

a. The primary data elements for analysis are the answers to the questions contained in the data form questions for the appropriate command and control network for CAS. (ANNEX C)

(1) Form questions have been identified with a particular action and node. These actions include initial request, abort/cancellation/disapproval, etc. These forms may change from exercise to exercise in order to adjust for the available information and minor changes to improve the content of the information collected. The questions are designed to gather the following types of information:

(a) The clock time of specific events identified in the network description in ANNEX E.

(b) The success or failure to perform a CAS command and control function where success is a precondition for the occurrence of the next event.

(c) The occurrence of delays which are not the result of a failure to perform a CAS command and control function.

(d) Causes of failure to perform functions and delays.

(e) Mission related variables such as weather/visibility, type target marker, terrain conditions, etc.

(2) After each exercise the quantitative data elements will be used to construct a time history on each immediate CAS request. The qualitative data will be filed along with the quantitative mission data so that various combinations for retrieval can be obtained. The data reduction process is described in detail in ANNEX G.

b. The information flow on selected significant communication nets in the command and control networks will be recorded using a VRS. These recordings will be used as backup data where voids exist in the manual data collection or as a source to sort out the differences which may occur between the quantitative data from different sources. It is not intended to use the VRS to evaluate the data collectors, but rather as a source to sort out significant variations in the data and fill in the voids where they exist.

c. The Range Measuring System (RMS-2), is planned to be used during two training exercises included on the JCS-approved list of exercises for data collection. The primary data to be derived from this equipment will be information on the relative positions of ground and air elements and corresponding relative times at which events involving them occur. Definitive detailed procedures for the employment of the RMS-2 and subsequent use of data derived therefrom have not been fully established. In accordance with guidance contained in paragraph 2g, JCSM-562-73, dated 19 Dec 73, USREDCOM in coordination with LANTCOM, will continue to examine the requirement for RMS-2 use. Consideration will be given to the results, exercise experience, and data collected during the first four exercises. Further clarifying details and/or recommendations for use of the RMS-2 will be provided via either the required quarterly report or in a special report.

5. MISSION CLASSIFICATION.

a. A classification of immediate CAS request histories has been developed to aid in the evaluation (Figure 4-2) (ANNEX F). The requests will be classified as either complete or incomplete. A completed request refers to those missions which have simulated first weapons delivery. These would include aborted missions which are replaced with another mission/event. The completed requests are classified by no delays and one or more delays. A distribution of the causes of the delays in each of the phases will be developed in the analysis methodology. The incomplete requests are classified as those disapproved or cancelled. The cancelled or disapproved requests may be further subdivided by source. This mission classification scheme is the basis for application of a series of statistical models to determine response times, frequencies of aborts and cancellations, and distribution of causes.

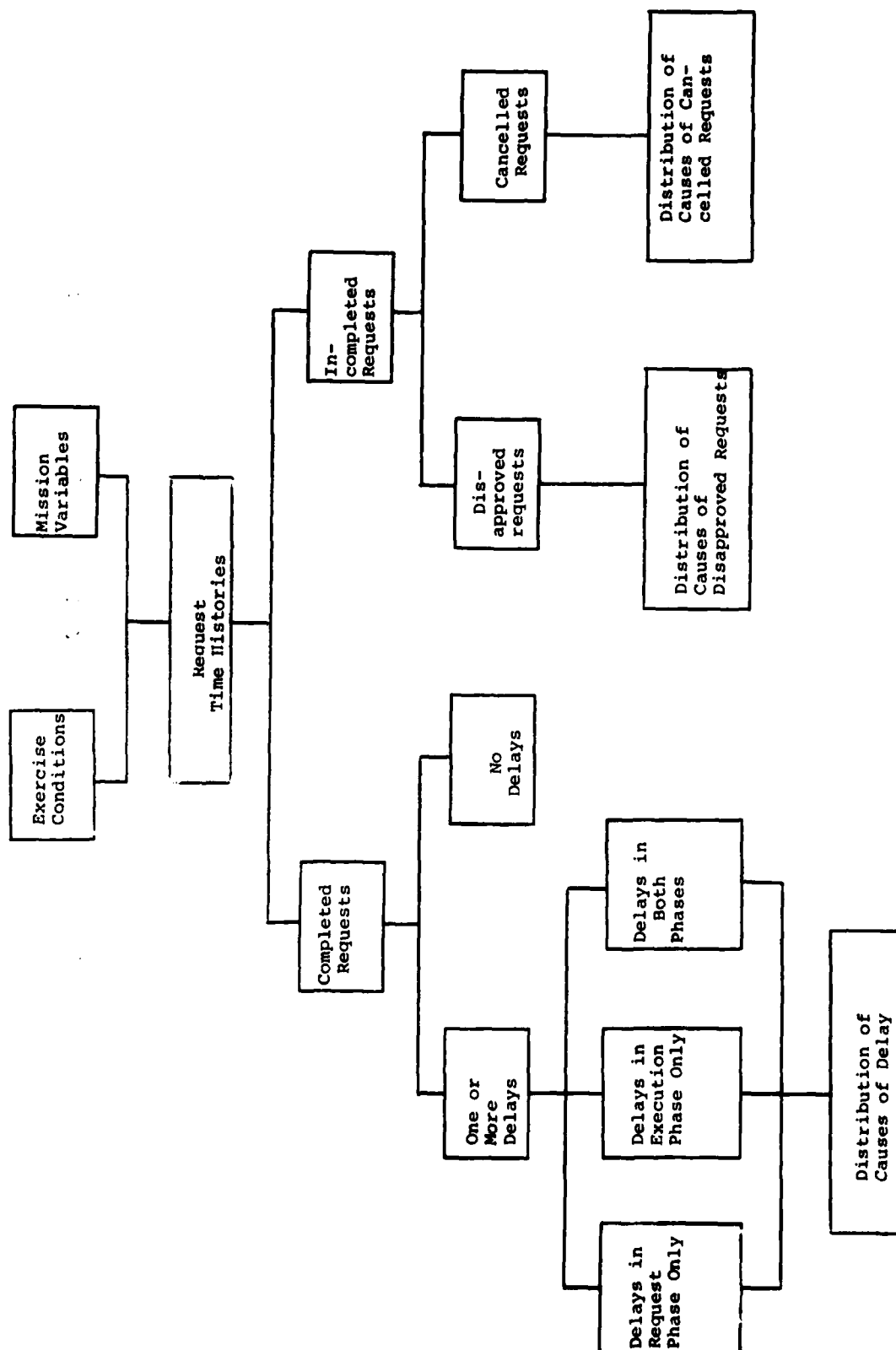


Figure 4-2. Classification of Mission Histories for Analysis.

6. ESTIMATION OF MEASURES OF ANALYSIS.

a. General.

(1) The concept of analysis discussed in Chapter 2, paragraph 3, is to determine immediate CAS mission response times, associated frequencies and causes of delays, disapprovals and cancellations as a function of selected exercise conditions. To implement this concept, a test design was established for use as guidance in scenario development to insure that an adequate sample size of mission related data is available for analysis, and to establish data analysis procedures before the fact rather than after. The test design portrays the conduct of immediate CAS missions in exercises which can be described by a set of base case and deviations from base case conditions. All of the CAS Validation Objectives that are associated with the exercise conditions can be addressed in this conceptual manner. In practice it will be necessary to determine the conditions that actually occur during an exercise and to classify the CAS requests by the exercise conditions. Once the classification of CAS request by actual exercise conditions are completed and the mission related data reduced, the analysis of data can begin.

(2) Estimates of response times, frequency of delays, disapprovals and cancellations, to include causes, will be determined and presented for the actual exercise conditions under which the missions were performed. The actual exercise conditions may be base case, one deviation from base case or two or more deviations from base case. The procedures for estimating the measures of analysis are the same for any set of exercise conditions that may be recorded.

b. Frequency and Causes of Disapprovals and Cancellations.

(1) For a given set of exercise conditions, the first step in the analysis is to determine the percentage of requests that are complete and incomplete. For those CAS requests that are incomplete, the percentage of disapproved and cancelled requests would be determined. A comparison of the percentages for base case and deviations from base conditions would indicate measures of degradation which may be attributable to differences in exercise conditions. An example of the presentation of this type of information is shown in Table 4-1.

(2) For incomplete, disapproved and cancelled requests, the distribution of causes categorized by CAS Validation Objectives will be analyzed and presented. A comparison of these distributions for various exercise conditions would indicate whether or not the exercise conditions caused changes in the distributions. In addition, the frequency of disapprovals and cancellations categorized by network element or agency will be analyzed, presented and compared for various exercise conditions.

c. Frequency and Causes of Delays.

(1) For the CAS requests that were completed, the distribution of the number of delays per request will be determined. This distribution would indicate the percentage of missions with zero delays, one delay, two delays, etc., as a function of exercise conditions. The means and variances of these distributions would also be determined.

(2) The following percentages will be computed for completed requests.

- (a) Percent of missions with one or more delays.
- (b) Percent of missions with delays in the request phase only.
- (c) Percent of missions with delays in the execution phase only.
- (d) Percent of missions with delays in both phases.

TABLE 4-1. Frequency of Incomplete Requests

BASE CASE (1)	SUBSTANTIAL AIR THREAT (2)	DIFFERENCE (1) - (2)	SIGNIFICANCE
.10 (10/100)	.33 (20/60)	-.23	
.20 (2/10)	.75 (15/20)	-.55	
.80 (8/10)	.25 (5/20)	+.55	

Incomplete

Disapproved

Cancelled

Sample Sizes

Base Case: 100 Missions
Substantial
Air Threat: 60 Missions

(3) Again, a comparison of the above percentages for base case and deviations from base case conditions would indicate measures of degradation which may be attributable to differences in exercise conditions. An illustration of a frequency of delay comparison is shown in Table 4-2.

(4) Each of the categories of delays listed above would be subdivided into delays attributable to the failure to perform a CAS function (i.e., failure to transmit with primary means of communication, etc.) and delays which are not attributable to inability to perform a function. Percentages for each of these subcategories will be determined and presented in tabular form.

(5) Distributions of causes of delays, categorized by CAS Validation Objective and CAS element or agency, would be presented in tabular form.

d. Determination of Response Times.

(1) The application of analytical techniques presented in this chapter assumes that data from two or more exercises will not be pooled.

(2) The cumulative distribution of immediate CAS mission response times as a function of paths/alert postures will be estimated by fitting a two-fold mixed Weibull distribution to data on completed missions. This distribution is given by

$$F(t) = pF_1(t) + (1-p)F_2(t),$$

where

p = percentage of missions with no delays for a given set of exercise conditions, and

$(1-p)$ = percentage of missions with one or more delays for a given set of exercise conditions.

The function $F_i(t)$ is the three parameters Weibull distribution. This distribution is given by

$$F_i(t) = \begin{cases} 1 - \exp[-(t - \alpha)^{\beta} / \theta] & , t \geq \alpha_i \\ 0 & , t < \alpha_i \end{cases}$$

The parameter α is referred to as the location parameter. The parameter $1/\theta$ and β are referred to as scale and shape parameters respectively.

(3) For $m=1$ this distribution reduces to the two-parameter exponential distribution. For $m=4$, the Weibull very closely approximates the normal distribution.

(4) The two-fold mixed Weibull distribution will be used to determine the optimistic, most likely, and pessimistic response times as a function of exercise conditions. In addition, the three parameter Weibull will be used to determine the cumulative distribution of completion times for the request and execution phase of an immediate CAS mission, and for increments of elapsed times within these phases. A detailed discussion of all elapsed time is given in Annex E.

(5) Response time distribution derived from exercise data will be used to:

(a) Validate the response times in the JSTF CAS Study Phase II;

TABLE 4-2. Frequency of Delays

BASE CASE (1)	ECM (2)	DIFFERENCE (1) - (2)	SIGNIFICANCE
.05 (5/100)	.66 (40/60)	-.61	
.40 (20/50)	0.0 (0/40)	+.40	
.40 (20/50)	.10 (4/40)	+.30	
.20 (10/50)	.90 (36/40)	-.70	

One or more
Delays

Delay in Re-
quest Phase
Only

Delays in
Execution
Phase Only

Delays in
Both Phases

Sample Size:

Base Case: 100 Missions Completed
ECM: 60 Missions Completed

(b) Determine the effects of delays on response times for a given set of exercise conditions; and

(c) Determine the degradation in response times attributable to deviations from base case conditions.

The presentation of results for the latter two applications is illustrated in Figures 4-3 and 4-4.

(6) If sufficient data is collected, response time distributions will be determined as a function of the mission variables listed in ANNEX E, Section 6.

7. ANALYSIS METHODOLOGY.

A methodology has been developed to treat the measures of analysis. Details are presented in Annex F. After the first or succeeding exercises, it may be necessary to adjust this methodology based on the data collected. Included in this methodology for each objective are suggested displays for the data generated (Table 4-3). These displays will be utilized by the report-writing and analysis section.

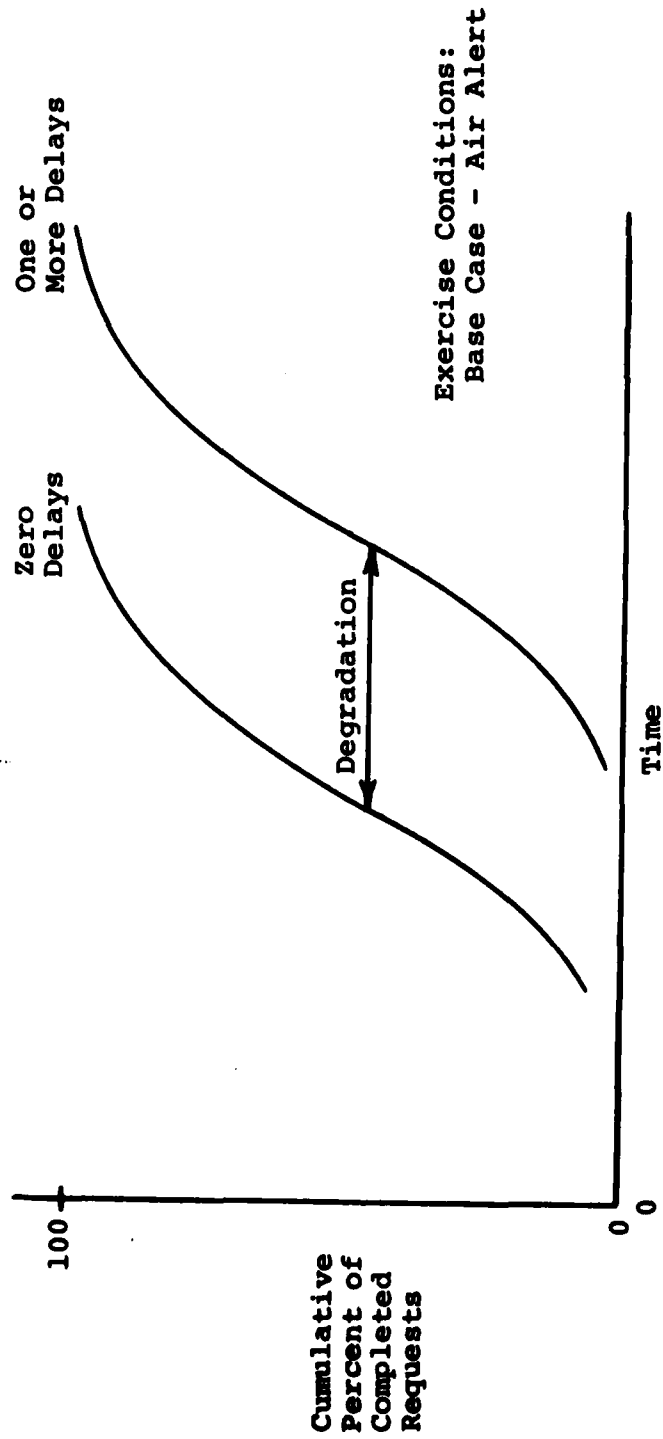


Figure 4-3. Effects of Delays on Response.

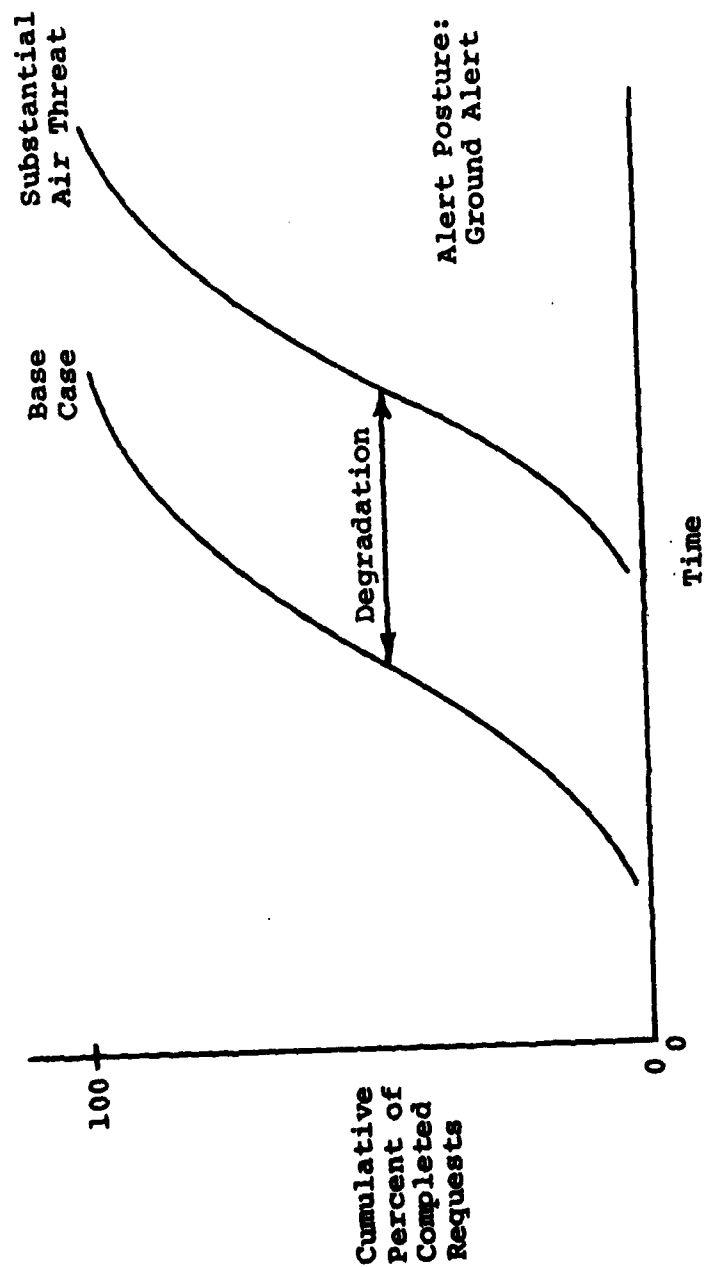


Figure 4-4. Effect of Substantial Air Threat on Response Time

TABLE 4-3 - ANALYSIS METHODOLOGY FOR EACH OBJECTIVE

OBJECTIVE

ACTION

1. For the applicable command and control network for CAS determine the response time for those complete immediate CAS requests conducted under Base Case conditions. Determine the statistical distribution of these times for each path in the network. Display the results as follows:

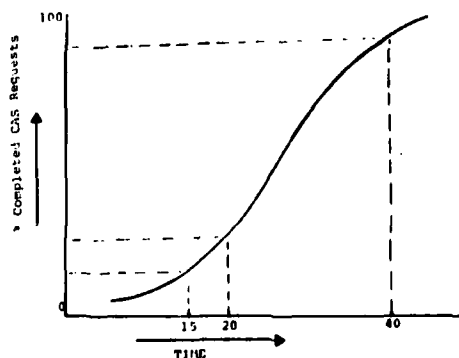
NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS
EXERCISE CONDITIONS: BASE CASE RESPONSE TIME

PATH IDENTIFICATION	NO. SAMPLES	MIN	MEAN	MAX	STANDARD DEVIATION
B: CP/TACP - BANC - AIR ALERT	10	2	5	8	1
B: CP/TACP - BANC - CRC - AIR ALERT	20	6	10	14	2
B: CP/TACP - BANC - CRC - DIVERT	20	5	8	16	3
B: CP/TACP - BANC - BANC - GROUND ALERT	15	3	11	15	2
B: CP/TACP - BANC - CRC AIR ALERT	10	5	10	17	3
B: CP/TACP - TANC - CRC DIVERT	15	6	9	14	2
B: CP/TACP - TANC - BANC - GROUND ALERT	20	8	12	20	4

NOTE: Information in Italics shown as an example.

Add any other path which processed ten or more immediate CAS requests. A cumulative distribution of the immediate CAS requests completed will be developed. A plot for each path in the system, as shown below, for completed Base Case conditions will be developed. The percentage of mission completed in fifteen, twenty, and forty minutes will be compared with those in the JSTF CAS Study Phase II report.

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS.
EXERCISE CONDITIONS: BASE CASE
NETWORK PATH: BRCP - BDECP - DIV TOC - DIV GROUND ALERT



NOTE: Information in Italics shown as an example.

TABLE 4-3 (Continued)

1. (Cont'd) For the applicable command and control network for CAS, determine the processing, communication, and transit times as a function of selected conditions. Determine the statistical distribution of these times. Display the results as follows:

PROCESSING TIME

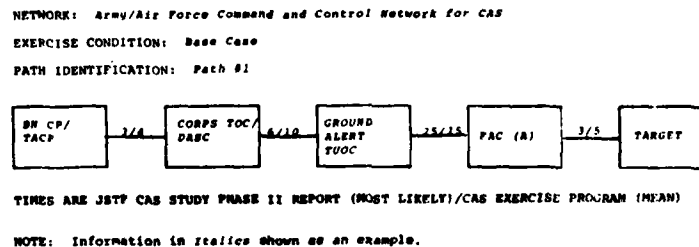
NETWORK: NAVY/MARINE COMMAND AND CONTROL NETWORK FOR CAS CONTROL AFLOAT

EXERCISE CONDITION:

MODE	NR. SAMPLES	MIN	MEAN	MAX	STANDARD DEVIATION
BN CP FAC	15	1	2	3	1
TACC/SACC	15	2	5	8	2
FAC	15	1	2	3	1
ASRT	15	1	3	4	2

NOTE: Information in *italics* shown as an example.

A similar table will be developed for the communications times, link times, and transit times. Those link times in the JSTF CAS Study Phase II report will be compared statistically with the measured values in the Validation program. A display for the various paths in this comparison is shown below:



A cumulative distribution will be developed for processing time, communication time, and transit times. A typical plot is as follows:

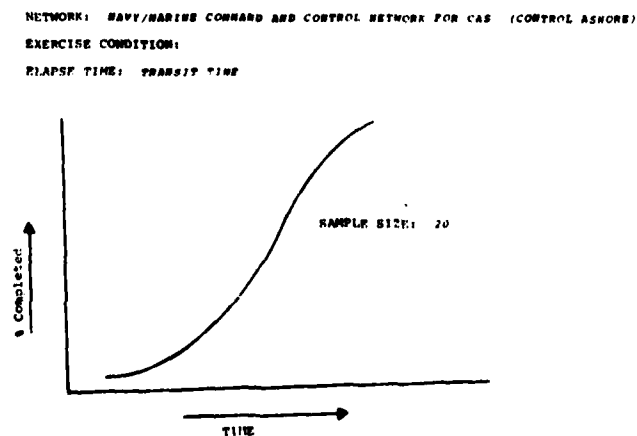
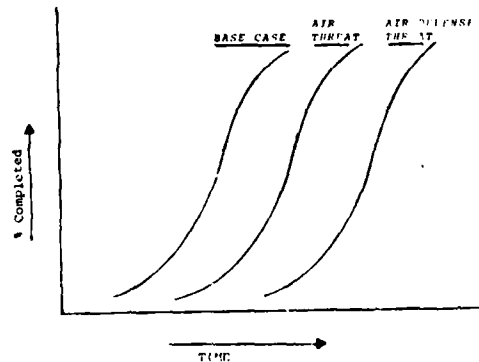


TABLE 4-3 (Continued)

1. Compare the various times for the alert posture, tactical situation, and various other combinations. A typical plot is shown below:

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS
 EXERCISE CONDITION: DEVIATIONS FROM BASE CASE - AIR THREAT
 ELAPSE TIME: TRANSIT



NOTE: Information in *italics* shown as an example.

The various times will also be tabulated as follows. Statistical tests will be conducted to determine if there is a statistical significance between the various elements of air threat, tactical situation, alert posture, etc., with confidence limits on the means.

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS
 EXERCISE CONDITION: ALERT POSTURE

RESPONSE TIME	AIR ALERT			DIVERT			GROUND ALERT		
	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX
REQUEST PROCESSING									
REQUEST COMMUNICATIONS									
TRANSIT									
ETC									

NOTE: Information in *italics* shown as an example.

TABLE 4- 3 (Continued)

1. (Cont'd) Develop for each path in the command and control network for CAS the various response times. Compare these response times with the appropriate times in the JSTF CAS Study Phase II report.

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS

EXERCISE CONDITIONS: COMPLETED BASE CASE

INITIAL NODE	TERMINAL NODE	CAS PHASE II STUDY RESULTS			CAS TEST RESULTS		
		OPTIMISTIC TIME	MOST LIKELY TIME	PESSIMISTIC TIME	OPTIMISTIC TIME	MOST LIKELY TIMES	PESSIMISTIC TIME
BN TACP	CORPS DASC						
CORPS DASC	TUOC						
TUOC	GROUND ALERT						
GROUND ALERT	FAC						
FAC	TARGET						
TOTAL							

NOTE: Information in *italics* shown as an example.

Develop the system/node response times for deviation from Base Case and other selected variables.

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS

CONDITIONS	LINK TIMES	NO. SAMPLES	MIN	MEAN	MAX	STD. DEVIATION
DEVIATIONS	NODE TO NODE					
NIGHT	A1 to A2	20		3		2
	A4 to B1	10		6		1
	D1 to F1					
REDUCED	A1 to A2	0		1		.5
WEATHER	etc.					
VISIBILITY						
etc.						

NOTE: Information in *italics* shown as an example.

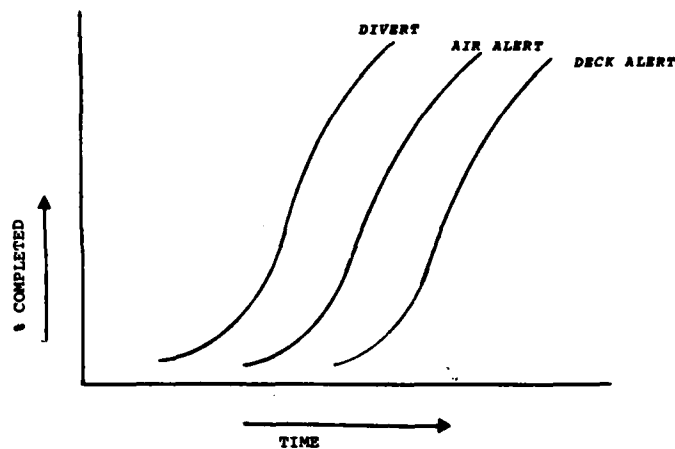
TABLE 4- 3 (Continued)

1. (Cont'd) Develop cumulative distributions for the various deviations from Base Case and selected combinations of mission variables, i.e., alert posture, tactical situation, etc.

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS (CONTROL ASHORE)

EXERCISE CONDITION: BASE CASE

NEW/IMPROVED EQUIPMENT: FM RADIOS



NOTE: Information in *ITALICS* shown as an example.

Develop an analysis of delays, to include frequency and cause analysis. This will follow the classification scheme identified in paragraph 8 above. A suggested format for the results follows:

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS

EXERCISE CONDITION: BASE CASE

NUMBER OF MISSIONS: 100

NUMBER OF DELAYS: 10

CAS OBJECTIVE	CASE	LOCATION	REASON FOR DELAY
2. COMMUNICATIONS	3 (1) (1) (1)	BN/TACP to DASC DASC TO TUOC GROUND ALERT TO FAC	AUTHENTICATION PROCEDURES R. F. INTERFERENCE COMMUNICATIONS SECURITY
4. SYSTEM CAPACITY	2 (1) (1)	DASC TO TUOC GROUND ALERT TO FAC	DASC OVERLOADED FAC OVERLOADED
5. TARGET ACQUISITION	2 (1) (1)	FAC TO TGT ASRT TO TGT	ATTACK PILOT COULD NOT INITIALLY IDENTIFY TGT/REFERENCE POINT FREQUENCY INTERFERENCE
9. DAMAGE TO INDIVIDUAL ELEMENTS	1	FAC TO TGT	FAC KNOCKED OUT -- ATTACK AIRCRAFT TO ALTERNATE CONTROLLER
9. INTELLIGENCE/FRIENDLY DATA	1	FAC TO TGT	ATTACK AIRCRAFT COULDN'T LOCATE FRIENDLIES.
10. COMPATIBILITY/INTEROPERABILITY	1	FAC TO TGT	ATTACK AIRCRAFT COULD NOT NET WITH GROUND COMMANDER

NOTE: Information in *italics* shown as an example.

TABLE 4-3. (Continued)

1. (Cont'd) An analysis of the delays with respect to the CAS validation objectives will be accomplished. The various delays have been identified with the CAS validation objectives as shown below. A display for the analysis of these delays by objective is shown in the next display.

DELAYS BY CAS VALIDATION OBJECTIVE

COMMUNICATIONS	Communication interoperability Authentication procedures Radio frequency interference Communications security Communication saturation Intermittent communication
SYSTEM CAPACITY	CAS command and control element capacity (BASC, CRC, CRP, PACP, PAC or ASRT for the Army/Air Force System)
TARGET ACQUISITION	Target ID by flight leader Lost target by PAC WX conditions Radio frequency interference Inaccurate target information Enemy air activity Administrative hold Red Smoke Fire Support coordination ECN Controller out of position
DAMAGE TO INDIVIDUAL ELEMENTS	Command and control element malfunction Radio frequency interference PAC knocked out Attack aircraft to alternate controller
INTELLIGENCE/FRIENDLY DATA	Friendly position information Enemy position information WX conditions Inaccurate intelligence information
COMPATIBILITY OF INTEROPERABILITY	Communication incompatibility Fire Support coordination Air Defense coordination Attack aircraft could not net with ground commander Authentication procedures

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS.

VALIDATION OBJECTIVE	NUMBER OF DELAYS	NUMBER MISSIONS WITH ONE OR MORE LINK(S) HAVING RESPONSE TIMES GREATER THAN ONE STD DEVIATION OF THE NODE MEAN	NUMBER MISSIONS WITH ONE OR MORE LINK(S) HAVING RESPONSE TIMES GREATER THAN TWO STD DEVIATIONS OF THE NODE MEAN
COMMUNICATION	1	4	1
SYSTEM CAPACITY	2	4	1
TARGET ACQUISITION	2	1	0
DAMAGE TO INDIVIDUAL ELEMENTS	1	2	2
INTELLIGENCE/FRIENDLY DATA	1	2	0
COMPATIBILITY// INTEROPERABILITY	1	1	2
TOTAL	10	14	6

NOTE: INFORMATION IN ITALICS SHOWN AS AN EXAMPLE.

TABLE 4-3 (Continued)

1. (Cont'd) An analysis of the disapprovals/cancellations, to include frequency and cause will be accomplished. A typical display of the causes and frequency is shown below.

DISAPPROVALS/CANCELLATION ANALYSIS BY NODE

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS

EXERCISE CONDITION: BASE CASE

<u>FUNCTION</u>	<u>NODE</u>	<u>CAUSE</u>	<u>NR. SAMPLES</u>	<u>FREQUENCY OF TYPE</u>	<u>FREQUENCY OF OCCURRENCE</u>
DISAPPROVAL					
CANCELLATION					

An analysis of the aborts/cancellations with respect to the CAS validation objectives will be accomplished. A typical display of the causes, by location as a function of the CAS Validation objectives, is shown below:

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS

EXERCISE CONDITION: BASE CASE

NUMBER OF MISSIONS: 100

NUMBER OF ABORTS: 10

<u>CAS OBJECTIVE</u>	<u>CASE</u>	<u>LOCATION</u>	<u>REASON FOR ABORT</u>
2. COMMUNICATIONS FAILURE			
7. TARGET ACQUISITION FAILURE			
8. DAMAGE TO INDIVIDUAL ELEMENTS			
9. INTELLIGENCE/ FRIENDLY DATA			
10. COMPATIBILITY/ INTEROPERABILITY			

NOTE: Information in *ITALICS* shown as an example.

TABLE 4-3 (Continued)

1.
(Cont'd) A summation display of the delays, aborts, and cancellations is shown below:

SUMMATION OF DELAYS, ABORTS, AND CANCELLATIONS										
NETWORK: Army Attack Helicopter Command and Control Network for CAS										
CONDITIONS	DEVIATIONS FROM BASE CASE				ALERT STATUS		TACTICAL SITUATION			
<u>VALIDATION OBJECTIVE</u>	<u>BASE CASE</u>	<u>NIGHT</u>	<u>-----</u>	<u>ECM</u>	<u>AIR ALERT</u>	<u>GROUND ALERT</u>	<u>DIVERT</u>	<u>DEFENSE</u>	<u>OFFENSE</u>	<u>RETROGRADE</u>
COMMUNICATIONS										
INTERGRATION CAPABILITY										
SYSTEM CAPACITY										
BAD WEATHER/NIGHT										
TARGET ACQUISITION										
DAMAGE TO INDIVIDUAL ELEMENTS										
INTELLIGENCE/FRIENDLY DATA										
COMPATIBILITY/INTEROPERABILITY										

NOTE: Information in *italics* shown as an example.

2. Identify immediate CAS requests having delays, aborts and cancellations resulting from communications problems. If the data sample is large enough, subdivide the communication delays into the component parts. Identify the alternate communication utilized. Tabulate this as follows:

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS			
REQUEST NR.	MODE	PROBLEM	ROUTE USED
UT 101	BN/CP	VRC-47	USED PH CAS NET

NOTE: Information in *italics* shown as an example.

Analysis of the effects of secure voice and ECM in relation to communication degradation will be accomplished. The frequency of communication difficulties by location is displayed as follows:

TABLE 4-3 (Continued)

2.
(Cont'd)

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS

REASON				
MODE	ECM	SECURE	AUTHENTICATION	R.F. INTERFERENCE
BN CP	4	3	2	3
BDE CP	0	1	1	0
DTOC	1	2	1	0
CTOC	5	2	1	4

NOTE: Information in *ITALICS* shown as an example.

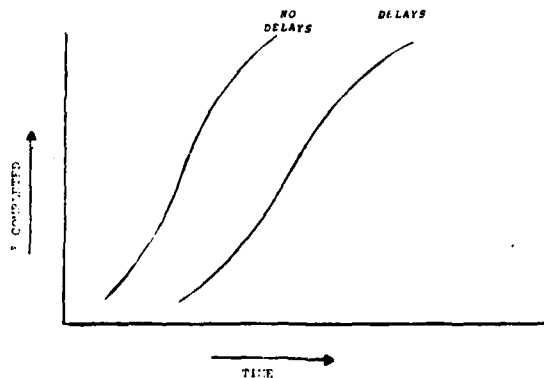
The secure voice capabilities will be tabulated and the frequency of delays, disapprovals, and cancellations attributed to the use of secure voice will be tabulated by node as follows:

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS

LOCATION	ECM	NR. DELAYS	CAUSE	DISAPPROVALS	CANCELLATIONS
BN CP					
BDE CP					
etc.					

A cumulative distribution of the response times for those CAS requests with and without delays resulting from the use of secure voice. A typical display is shown below:

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS



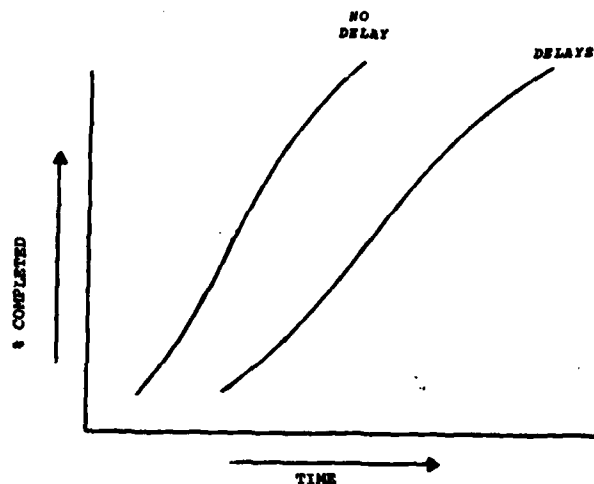
NOTE: Information in *ITALICS* shown as an example.

A statistical comparison of the various types of secure voice equipment will be made. Statistical tests will be used to identify any significant difference between the various types of equipment.

TABLE 4-3 (Continued)

2.
(Cont'd)

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS



NOTE: Information in *ITALICS* shown as an example.

A statistical comparison of the various types of secure voice equipment will be made. A statistical test will be used to identify any significant differences between the various types of ECM.

The ECM effects will be tabulated and the frequency of delays, disapprovals, and cancellations attributed will be tabulated by node as follows:

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS

<u>LOCATION</u>	<u>SECURE VOICE EQUIP.</u>	<u>NR. DELAYS</u>	<u>CAUSE</u>	<u>DISAPPROVALS</u>	<u>CANCELLATION</u>
BN CP					
BDE CP					
etc.					

NOTE: Information in *ITALICS* shown as an example.

A cumulative distribution of the response times for those CAS requests with and without delays resulting from a typical display is shown below:

TABLE 4-3. (Continued)

3. Identify the immediate CAS request by type of coordination received, i.e., fire support, air defense, or air space management. Determine the number and frequency of delays, disapprovals, and cancellations by type coordination. Shown below is a typical display for fire support coordination. A display will be required for the other types of coordination.

FIRE SUPPORT COORDINATION

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS

<u>NODE</u>	<u>DELAYS</u> <u>NO./FREQUENCY %</u>	<u>DISAPPROVALS</u> <u>NO./FREQUENCY %</u>	<u>CALCULATIONS</u> <u>NO./FREQUENCY %</u>
BN TACP	0/0	0/0	0/0
BDE TACP	4/.4	1/.1	1/.1
DIV TACP	3/.3	0/.3	2/.2
CORPS DASC	5/.5	0/0	0/0
TACC	2/.2	0/0	0/0
TUOC	1/.1	0/0	0/0
CRC	0/0	0/0	0/0
CRP	0/0	0/0	0/0
FACP	0/0	0/0	0/0
FAC(A)	2/.2	3/.3	0/0
FAC(G)	2/.2	2/.2	0/0
ASRT	1/.1	0/0	0/0
FLIGHT LEADER (AIR ALERT)	0/0	0/0	0/0
FLIGHT LEADER (GROUND ALERT)	0/0	0/0	0/0
FLIGHT LEADER (DIVERG)	0/0	0/0	0/0
TOTAL	19/1.9	6/.3	3/.3

3. Calculate the response times associated with the various missions delayed. A display for those associated with fire support problems is shown below. A similar display for the other types of coordination will be developed. Statistical tests will be used to determine any statistical significance between the non-delay and those delayed.

FIRE SUPPORT COORDINATION

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS

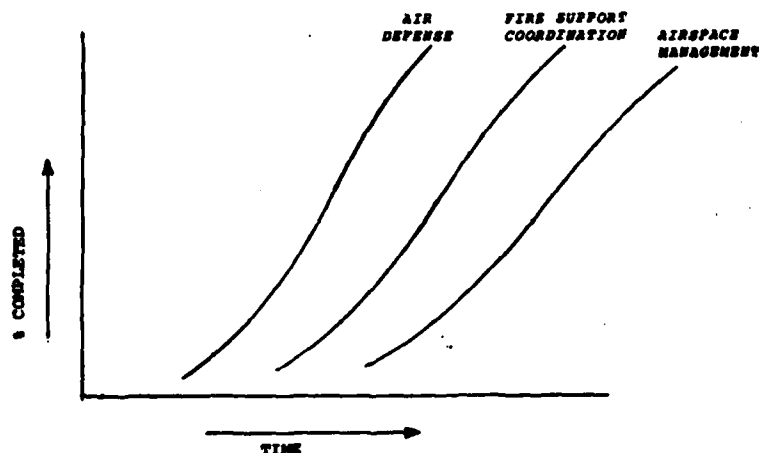
<u>NODE-TO-NODE</u>	<u>NO.</u> <u>SAMPLES</u>	<u>MIN</u>	<u>MEAN</u>	<u>MAX</u>	<u>STANDARD</u> <u>DEVIATION</u>
BN TACP TO CORPS DASC	10	1	4	7	1
BDE TACP TO CORPS DASC	5	1	3	8	2
DIV TACP TO CORPS DASC	8	1	4	6	1
CORPS DASC TO TACC	8	2	6	8	1
CORPS DASC TO TUOC	10	2	5	10	2
CORPS DASC TO CRC	5	1	6	8	1
TUOC TO FLIGHT LEADER, etc.	10	1	4	10	2

NOTE: Information in *ITALICS* shown as an example.

TABLE 4-3 (Continued)

3. Cumulative distribution of the response times for CAS requests delayed by coordination will be developed. They will be plotted as follows:

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS



4. Identify those immediate CAS requests with delays resulting from saturation. In those cases where saturation was identified, evaluate the input and output per unit of time at the node. Also determine the effect of saturation on response times at the node. Typical displays are as follows:

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS (CONTROL AFLOAT)

<u>MODE</u>	<u>NO. REQUESTS WHEN SATURATED</u>	<u>MAXIMUM NO. NOT SATURATED</u>	<u>REASON SATURATED</u>
DASC			
PAC			

NOTE: Information in *ITALICS* shown as an example.

A frequency and cause of disapprovals/cancellations resulting from saturation will be portrayed as follows:

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS (CONTROL AFLOAT)

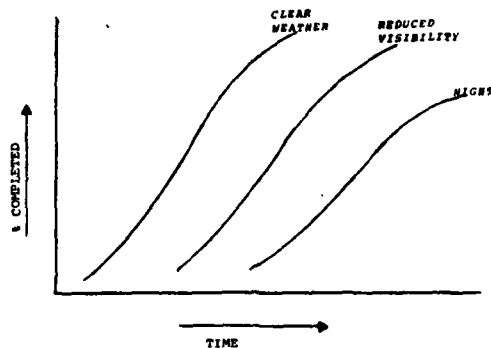
<u>MODE</u>	<u>DISAPPROVALS</u>		<u>CANCELLATIONS</u>		<u>REASON</u>
	<u>NUMBER</u>	<u>FREQUENCY</u>	<u>NUMBER</u>	<u>FREQUENCY</u>	
DASC					
PAC					

NOTE: Information in *ITALICS* shown as an example.

TABLE 4-3 (Continued)

- 6 For each exercise day the records of weather conditions will be maintained and response times for selected conditions will be computed. A cumulative distribution will be developed for reduced weather and night conditions. If sufficient data exists, the weather at launch site, en route, and target area will be analyzed separately. Typical displays generated are:

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS



NOTE: Information shown in *ITALICS* shown as an example.

Statistical tests will be used to identify significant differences.

A frequency and cause distribution analysis of delays, disapprovals, and cancellations will be portrayed as follows:

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORKS FOR CAS

DELAY

<u>NODE</u>	<u>NO. OF DELAYS</u>	<u>CAUSE</u>
<i>BN CP/TACP</i>		
<i>CORPS/DASC</i>		
<i>TUOC</i>		
<i>CRC</i>		
<i>TACC</i>		
<i>etc.</i>		

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORKS FOR CAS

<u>NODE</u>	<u>DISAPPROVALS</u>	<u>CANCELLATIONS</u>	<u>CAUSE</u>
<i>BN CP/TACP</i>			
<i>CORPS/DASC</i>			
<i>TUOC</i>			
<i>TACC</i>			
<i>CRC</i>			

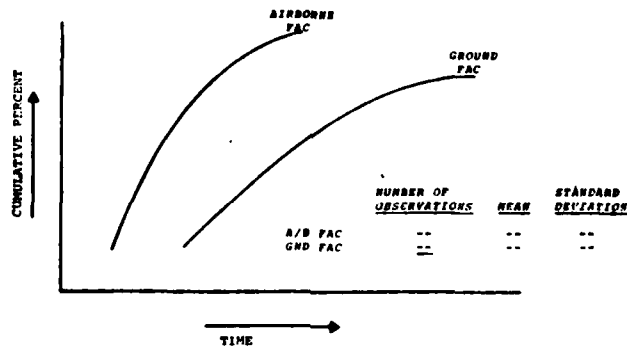
NOTE: Information in *ITALICS* shown as an example.

TABLE 4-3 (Continued)

- 7 The immediate CAS requests will be identified by the type terminal control. For each request the response time will be determined, using the measures of effectiveness. Cumulative distribution will be developed for the various marking systems. Typical displays are shown below:

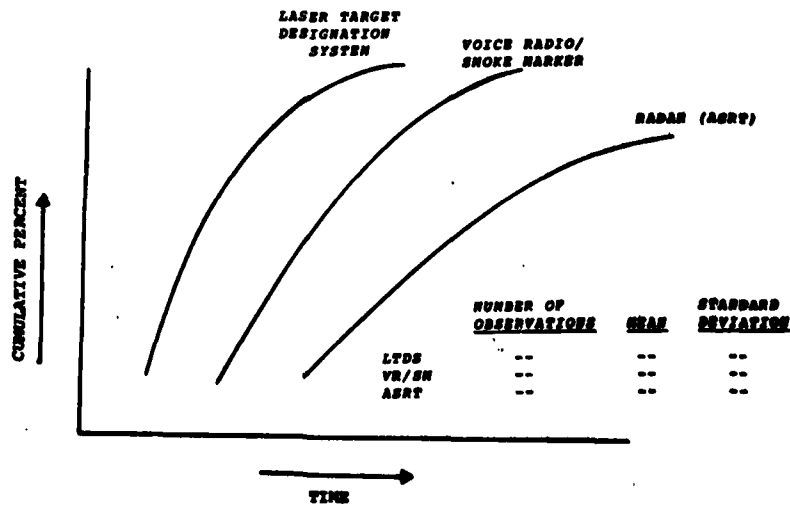
TIME FROM ARRIVAL IN TARGET AREA TO FIRST DELIVERY ON DESIGNATED TARGET: AIRBORNE FAC VERSUS GROUND FAC

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS



TIME SPENT IN TARGET AREA AS A FUNCTION OF PROCEDURES AND EQUIPMENT USED TO MARK TARGET

NETWORK: NAVY-MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS



NOTE: Information in *ITALICS* shown as an example.

TABLE 4- 3 (Continued)

7
(Cont'd)

The number of delays, aborts, and cancellations caused by target identity/marking system will be identified and assessed in terms of exercise conditions, e.g., the enemy air defense threat may cause the FAC to fly higher than normal and create a target identity problem. The delays, aborts, and cancellation information will be displayed as follows:

NETWORK: ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CAS

BY TYPE CONTROL	DELAYS	ABORTS	CANCELLATIONS	REASON
FAC (A)				
FAC (B)				
ASST				
<u>BY ENEMY CONDITION</u>				
BASE CASE				
NIGHT				
SECURE VOICE				
SUBSTANTIAL AIR THREAT				
ECN				
etc.				

NOTE: Entries in the table are numbered by reason. A condition may have more than one entry.

8. The thrust of this evaluation is to assess the shift in response times to cumulative distribution between the damaged nodes and the Base Case standard. A table of the various damaged elements identifying the cause, time out, time back in, and immediate CAS requests involved will be developed.

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL FOR CAS

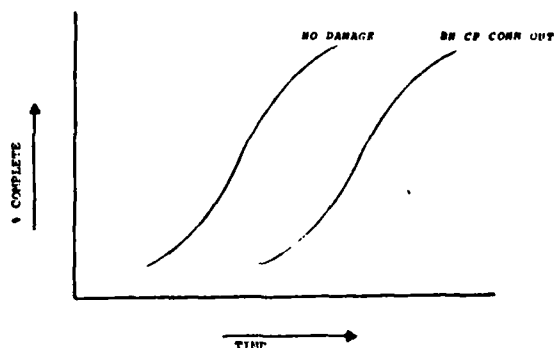
CODE	ELEMENT DAMAGED/EQUIPMENT	TIME OUT	TIME OVERCOME	CAS REQUESTS PROCEEDED
BN CP	All Communications destroyed	06-1130	07-1000	OT 1201 OT 1202 OT 1204
BDE CP				
etc.				

NOTE: Information in ITALICS shown as an example.

TABLE 4-3 (Continued)

8. (Cont'd) If data exists, develop a cumulative distribution in response time to identify the shift. A sample plot is shown below.

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL FOR CAS



NOTE: Information in *ITALICS* shown as an example.

9. Where quantitative data on intelligence processing, both quantity and quality, exists the following scheme will apply. Identify those immediate CAS requests with intelligence delays, i.e., friendly intelligence, enemy information, and target information. Determine the frequency of delays by node. Display the information as follows:

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK CAS (CONTROL ASHORE)

DELAYS

<u>NODE</u>	<u>FRIENDLY INFO.</u>	<u>ENEMY INFO.</u>	<u>TARGET INFO.</u>	<u>REASON</u>
BN CP FAC				
BASC				
TACC				
ASST				

NOTE: Information in *ITALICS* shown as an example.

Enter in the number of delays by category for each node in the system. Add a line entry for each category.

TABLE 4-3 (Continued)

9. Analyze the frequency and cause of delays, disapprovals, and cancellations associated with intelligence. Display the results as follows:

NETWORK: ARMY ATTACK HELICOPTER COMMAND AND CONTROL NETWORK FOR CAS

NODE	DELAYS		DISAPPROVALS		CANCELLATIONS	
	NUMBER	FREQUENCY	NUMBER	FREQUENCY	NUMBER	FREQUENCY
BN CP						
BDE CP						
DIV TOC						

NODE	NUMBER	REASON	NUMBER	REASON	NUMBER	REASON
BN CP						
BDE CP						
DIV TOC						

NOTE: In the reason the reroute must be specified with any time information on the delays incurred.

NOTE: Information in *ITALICS* shown as an example.

10. The analysis of compatibility/interoperability will be centered around delays, disapprovals, and/or cancellations attributed to these problems. Where quantitative data exists, the following displays will be developed using the dendritic diagram and the measures of analysis. Typical displays of frequency and cause are as follows:

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS

EXERCISE CONDITIONS (If Applicable):

FREQUENCY	DELAYS		DISAPPROVALS		CANCELLATIONS	
	NO.	FREQ.	NO.	FREQ.	NO.	FREQ.
NODE						

BN CP FAC

TACC

ASRT

CAUSE	DELAYS		DISAPPROVALS		CANCELLATIONS	
	NO.	REASON	NO.	REASON	NO.	REASON
NODE						

BN CP FAC

TACC

ASRT

TABLE 4-3 (Continued)

11. New/improved equipment identified by the sponsoring commands will be evaluated in relation to the total command and control network for CAS. Where possible the analysis will be conducted using one new variant. If data is available on combinations, these will be evaluated using the same techniques. Statistical distributions (min, max, mean and standard deviation) will be calculated for the response time, either system/element or agency, depending on the type of equipment employed. Where data exists, analyze for the various exercise conditions and mission variables. Display the information as follows:

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS (CONTROL AFLOAT)

EXERCISE CONDITION: BASE CASE

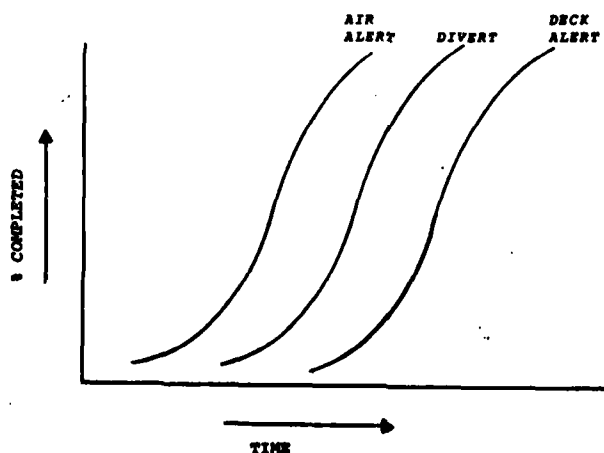
NEW/IMPROVED EQUIPMENT: fm radios

<u>NODES</u>	<u>MEAN RESPONSE TIME WITHOUT</u>	<u>STANDARD DEVIATION</u>	<u>MEAN RESPONSE TIME WITH</u>	<u>STANDARD DEVIATION</u>
FAC	10	3	5	1
ASRT	9	2	9	2
DASC	15	1	15	1
TACC	5	2	5	2
BN CP/FAC	2	1	2	1

Determine if there is any statistical difference in the means.

Calculate the cumulative distribution for each exercise condition for each new/improved equipment.

NETWORK: NAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS (CONTROL AFLOAT)



NOTE: Information in *ITALICS* shown as an example.

8. REPORT PREPARATION.

a. The following reports are required by JCS in the CAS Validation Program:

(1) Initial and final reports of first exercise (BRAVE CREW) will be submitted 45 days and 120 days after termination of the exercise.

(2) Quarterly reports will be submitted as specified by the Detailed Test Plan.

(3) Special reports will be submitted as requested or desired to highlight specific problems, accomplishments or other matters of immediate interest.

(4) The Final Report will be submitted by 31 December 1975 or 180 days after termination of the last exercise, whichever is later.

b. The information flow in the Joint Validation Headquarters from data collection in the field through analysis, report writing, and coordination to a document submitted to JCS is shown in Figure 4-5. The initial data in this system are the data elements identified in paragraph 4 above. These data elements will be checked for accuracy in the field and compiled into immediate CAS request histories. The reduction process will be accomplished by BDM. The outputs from this reduction will be used by the Operations Analysis Section to assist the Reports Section in preparation of required reports.

c. Reports preparation will be accomplished by the Reports Section using analyzed data and subjective comments as available.

d. The final report will address all individual exercises and will collate all results into a cohesive assessment of each of the three independent command and control networks for close air support. In addition, subjective comments relating to the validation effort provided by unified commands will be appended to the final report. Upon completion, the draft final report will be submitted to the CAS Validation Working Group for review.

e. Upon completion of Working Group review, the draft report will be submitted to USREDCOM, CINCLANT and USEUCOM for review. Subjective comments by the Unified Commands and their components on the analyzed data (See Annex B, DAP), should be made at this time. These subjective comments will be appended to the final report. Significant portions may be included in the report executive summary and in the main report as appropriate.

f. The draft final report will then be reviewed by the USREDCOM Steering Group who will, in turn, forward the draft to CINCLANT for final coordination.

g. Upon receipt of CINCLANT coordination, comments, USCINCRD will submit the final report to the JCS.

h. The final validation of CAS Phase II Report and the Brave Crew report will be structured as follows:

EXECUTIVE SUMMARY: Includes significant findings from the CAS Validation Program and a summary of subjective comments submitted by the Services and unified commands.

MAIN REPORT

SECTION I - GENERAL

1.1 Purpose.

1.2 CAS Validation Objectives.

1.3 Time and Space. Outline the geometry of the situation and the overall scheme of maneuver.

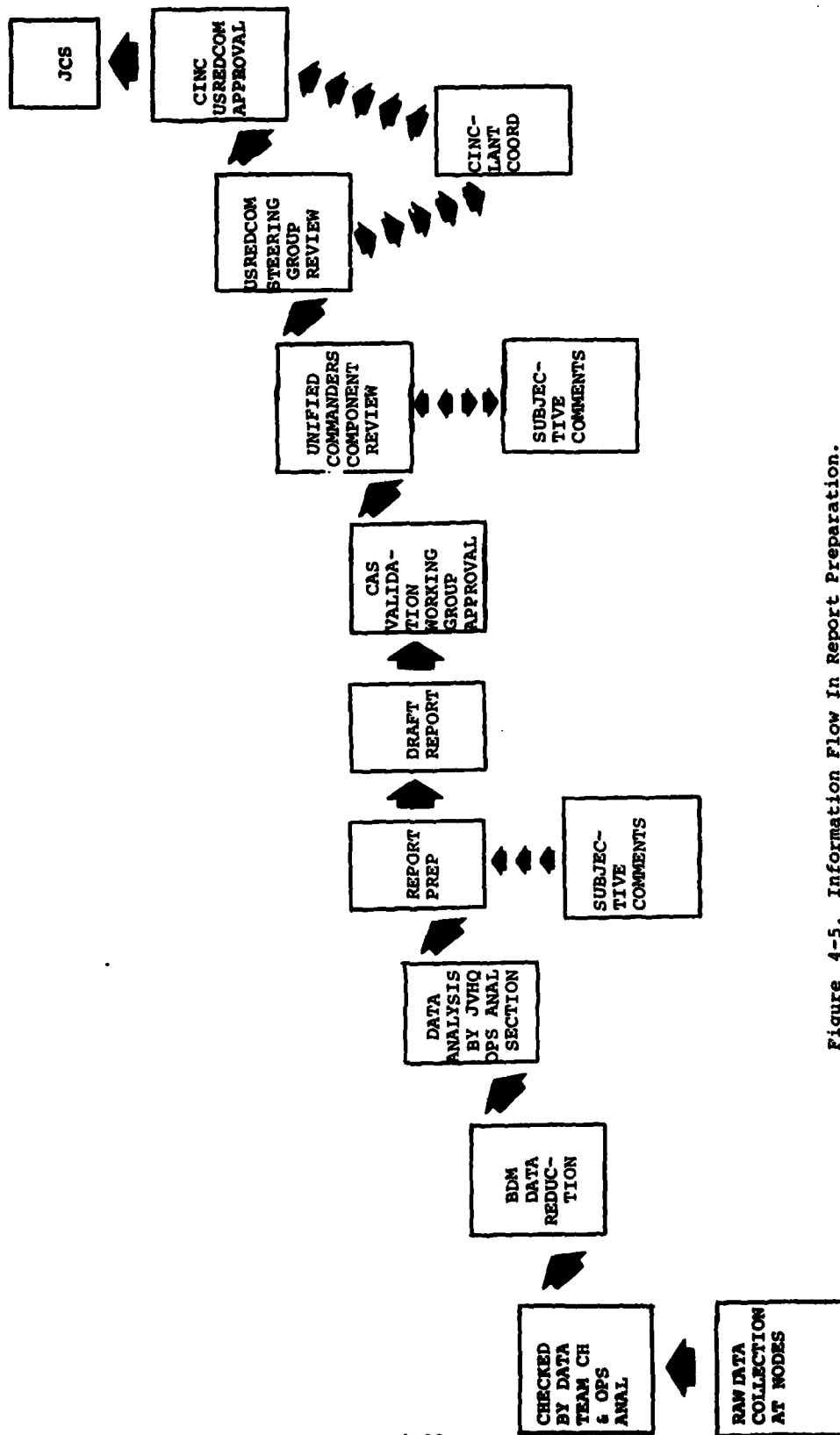


Figure 4-5. Information Flow In Report Preparation.

- 1.4 Approach. Identify the analysis approach and the structure of the report.

SECTION II - DISCUSSION OF RESULTS

- 2.1 Data Elements. Discuss the types of data and source.
- 2.2 Analysis by Objective. Analysis of the data as it applies to each objective. Augment and clarify with subjective comments where applicable. The charts, tables and figures for each objective in Table 4-3 will be selectively used in the analysis of the quantitative data.
- 2.3 Associated Findings. Include an analysis of any areas in addition to the objectives discussed above.
- 2.4 Comparison with JSTF CAS Study Phase II Results. Include comparative analyses of the link times and of the percentage of immediate CAS requests completed in fifteen, twenty and forty minutes.

SECTION III - CONCLUSIONS

Identify significant conclusions derived from the analysis.

ANNEXES As required (to include subjective comments).

ANNEX A

CAS VALIDATION OBJECTIVES

1. Objective No. 1. Determination of response times for immediate demands on the close air support (CAS) command and control system, including transmission, processing, and transit time.
2. Objective No. 2. Determination of communication requirements, both ground and airborne, at all levels, including secure transmission needs.
3. Objective No. 3. Determination of the capability to integrate CAS with other tactical operations in the combat area, including the consideration of fire support coordination, air defense, and airspace control functions.
4. Objective No. 4. Determination of maximum system capacity to handle target attacks under clear weather conditions.
5. Objective No. 5. Determination of training requirements for qualification and annual maintenance training of observers, air controllers, and operators for each level above company. Determination of training requirements for combat battalions and tactical air control system units in terms of CAS sorties per year.
6. Objective No. 6. Determination of the degradation of the system's ability to provide effective command and control of CAS at night, in bad weather, or under artificially reduced visibility.
7. Objective No. 7. Determination of the ability of various CAS target acquisition systems to detect and identify hostile targets and hand off these targets to an attacking agent.
8. Objective No. 8. Determination of the extent of system degradation resulting from damage to individual elements.
9. Objective No. 9. Determination of the functioning of intelligence information and friendly data availability as aids in decision-making within the command and control system. Examine information requirements, accuracies, and times involved in entering it in the system and making decisions based on it.
10. Objective No. 10. Determination of the compatibility and interoperability of the elements of the CAS command and control system.
11. Objective No. 11. Evaluation of the improvements offered by new/improved equipments in the other test objectives.

ANNEX B
SUBJECTIVE COMMENTS

1. GENERAL.

a. Subjective comments are judgments about situations or writings as perceived by an individual. For the purpose of the CAS Validation Program, subjective comments have been partitioned into several areas. This has been done to clarify the solicited comments. These areas are:

- (1) Subjective comments about each training exercise.
- (2) Subjective comments about apportionment and allocation as they pertain to the Army/Air Force command and control network for CAS.
- (3) Subjective comments on the test objectives.
- (4) Subjective comments about survivability.
- (5) Subjective comments on the contents of the draft final report.
- (6) Subjective comments about specific points.

b. Each of the above areas will be addressed in relation to the published guidance, and the scope of the comments desired. The scope of each area will be identified through a series of subject areas. If other areas are deemed pertinent, they should be included. Subjective comments received will be acknowledged and presented in the appropriate reports. These subjective comments will be used to amplify the quantitative results, but under no circumstances will they be modified or used to modify the quantitative results.

c. A methodology for summarizing and presenting the subjective comments received is included in paragraph 4.

2. BACKGROUND.

a. The primary data sources for the CAS Validation Program have been identified in the body of the DAP. Alternative data sources were identified in the TPC (Page 4-3, paragraph c, quoted below for ease of reference.)

"c. Alternative Data Collection Methods.

1. Alternative methods for collecting data are displayed in Figure 4-7. Test Objectives are listed under five general headings: (1) CPX; (2) Combat Data; (3) Service Models; (4) CAS Models; and (5) Subjective Comments of Test Objectives.

2. Alternative methods could be used to gather additional data for those objectives which are not adequately covered in a test or exercise. Large-scale dedicated exercises would be better for accomplishing the JCS tasking. However, funding limitations, safety restrictions, availability of forces and other constraints prevents the execution of a test/exercise large enough to accomplish all of the objectives within the JCS tasking. Therefore, a four-phased approach is desirable.

a. Conduct a CPX in conjunction with a test/exercise. For example, a CPX could be used to load an element in an effort to obtain the capacity of the C2 element; e.g., simulate airlift and

reconnaissance immediate/preplanned requests to assess the capabilities of a DASC in responding to CAS requests.

b. Combat data could be used as an input to validate portions of the C2 function not available from test/exercise results; e.g., integration of CAS with other tactical operations in a high intensity combat environment.

c. A computer model may be developed to incorporate the data derived from the CAS tests/exercises, CPX excursions, other computer results and combat data to assist in validating the test objectives.

d. Services and appropriate CINC's to provide subjective comments on test objectives."

These alternative data sources were constrained by JCS (JCS Memorandum (SM-398-73) dated 4 September 1973. Paragraph 2a and paragraph 5 quoted below for ease of reference.

"5. Within the area of alternate data sources, however, certain items of the TPC require modification. Sources such as a specialized computer CAS model, a dedicated CAS exercise, a separate intelligence study, or any other simulation techniques isolated from the exercise environment do not appear warranted at this time. Use of such data sources must await positive identification of the degree of data shortfall within the CAS test program and the decision to address such shortfalls."

The use of subjective comments was supported in the JCS Memorandum SM-398-73, (paragraphs 3 and 4 quoted below for ease of reference.).

"3. The central issue contained in both references 1b and 1c is the problem of achieving the test objectives in joint training and test exercises. The memorandum by the Deputy Secretary of Defense, dated 24 January 1973, directed '... the implementation of the detailed test plan in joint training and test exercises.' Data shortfall in this environment was anticipated and, in response to guidance by the Joint Chiefs of Staff, the TPC proposed alternate sources of data allocation to achieve the test objectives.

4. Every effort must be made, however, to answer the test objectives as completely as possible with empirical data from scheduled field exercises expanded, as appropriate, by command post exercises and field simulations. Subjective comments provided by the Services and commanders of unified commands must also be used to address the test objectives. DOD/Service programs, such as the Joint Target Acquisition Study, and combat data may also prove useful in expanding or supplementing data collected from the field exercise environment. All of these sources should combine to make the best resultant product."

This requirement for subjective comments was further amplified in JCS Message 0414492 Sep 73 (paragraphs 6 and 7 quoted for ease of reference.)

"6. Services and commanders of unified commands are requested to provide the necessary information, subjective documents, and support to the CAS working group at USREDCOM, both during the development of, and subsequently as required, by the Detailed Test Plan. They are also encouraged to provide comments, as deemed appropriate, on the development of the Detailed Test Plan.

7. Direct coordination between USREDCOM, LANTCOM, the Services, other appropriate unified commands, and WSEG is authorized to facilitate the accomplishment of the CAS Detailed Test Plan."

b. The above quoted references form the requirement for subjective comments. In addition to this general guidance, specific guidance in two areas has been promulgated by JCS, survivability, and apportionment and allocation.

c. In the areas of survivability, JCS has directed that it will be addressed through subjective comments (JCS Memorandum SM 562-73, dated 19 December 1973, paragraph 2h quoted for ease of reference).

"h. The impact of enemy air defenses, lethal envelopes, and exposure times on CAS aircraft and the associated effect on the CAS command and control systems may be deducted from CAS studies/exercises/operations. However, they are not specific objectives of the CAS command and control Validation Program. For purposes of this CAS Validation Program, survivability will be addressed in subjective comments submitted by commanders of the unified commands and in the intelligence play of the exercises."

d. The subject of apportionment and allocation was included in JCS Message 282350Z Jan 74 (paragraph 4e(2) quoted for ease of reference).

"Procedures for examining apportionment and allocation of air assets should be included."

This was clarified in a later message by USREDCOM to JCS (USREDCOM Message 201522Z Feb 74, paragraph 2 quoted for ease of reference.)

"Recommend that in the interest of clarity and direction that 4-e(2) be revised to read:
'Procedures for examining in a subjective manner the apportionment and allocation of CAS air assets as they pertain to the Army/Air Force CAS C2 System should be included.'"

JCS approved this clarification.

3. SUBJECTIVE COMMENTS CONTENT.

a. The content desired in each of the areas of subjective comments identified in paragraph 1 varies with the area. Within each area a discussion of the desired scope will be established through a series of subjects/questions. The command level to which each area will be addressed and the required submission time identified. All submissions will be addressed directly to:

Commander in Chief
United States Readiness Command
ATTN: RCJ5
MacDill AFB, Florida 33608

b. A discussion of each area follows:

(1) Subjective Comments about each Training Exercise. It is anticipated that the quantitative data from the CAS exercise program will not, by itself, permit a complete and meaningful answer to each of the ten CAS objectives. "A requirement may exist for...subjective comments to place the understandably constrained exercises in the context of the real-world environment. If the requirement exists, the Validation Headquarters may request the command sponsoring the exercise to provide subjective comments to fill data holes in specific areas or on specific objectives." (DTP, dated November 1973, paragraph 5.b.(c), page 3-8). Subjective comments will be submitted by unified commands sponsoring each exercise within 30 days after exercise termination. Unified commanders may solicit comments from exercise commanders, where applicable. Subjective comments are expected to provide a better insight into interpretation of the quantitative results. The suggested subjects are:

(a) Comment on the impact of exercise artificialities/restrictions on CAS responsiveness.

(b) Was the command and control system deployed and operated in accordance with standard procedures?

(c) During the conduct of the joint training exercise, was maximum capacity for processing immediate CAS requests/controlling aircraft in the terminal area reached or exceeded?

(d) Discuss availability of exercise intelligence in relation to immediate CAS command and control.

(e) Comment on the adequacy of the communications procedures for effecting coordination/integration of immediate CAS with fire support coordination, air defense, and airspace management.

(f) Comment on data collection compatibility with exercise operational requirements.

(g) What factors influence the decision to request fixed wing vs. attack helicopter support?

(h) Other comments relative to CAS asset utilization, system performance, training exercise environment and overall validation program to provide a better interpretation of the quantitative results.

(2) Subjective Comments about Apportionment and Allocation of Air Assets as they Pertain to the Army/Air Force Command and Control Network for CAS. As directed by JCS, the apportionment and allocation of air assets as they pertain to the Army/Air Force command and control network for CAS will be addressed by subjective comments. Subjective comments are solicited from USREDCOM and USEUCOM 60 days after each appropriate exercise. These comments will be included in the final Validation of Close Air Support Phase II Results report.

(3) Subjective Comments on the Test Objectives. Subjective comments are required on the CAS Validation Objectives. "It is the intent of the Joint Chiefs of Staff that appropriate unified commands submit comments on the test objectives." (JCS Memorandum, SM 562-73, dated 19 December 1973, paragraph 2.1.). Subjective comments are solicited from USREDCOM, LANTCOM, and USEUCOM 90 days after the first exercise they sponsor on a one time basis. These comments are required once enough experience has been gained with the objectives. Suggested subject areas are:

(a) Are the CAS Validation Objectives adequate to address the uncertainties in the analysis of the command and control portion of the JSTF CAS Phase II report?

(b) Is response time an adequate measure of the effectiveness of command and control for immediate CAS?

(c) To what degree can communications requirements be determined through training exercises?

(d) To what degree can systems capacity for CAS be determined in joint training exercises?

(e) Can system ability to provide CAS in bad weather and at night be determined in training exercises?

(4) Subjective Comments about Survivability. Within the CAS Validation Program, survivability will not be addressed in an empirical manner but through subjective comments. (JCS Memorandum SM 562-73, dated 19 December 1973, paragraph 2.h., quoted in paragraph 2 above). This subject will be addressed by USREDCOM, LANTCOM and USEUCOM 45 days after the final exercise. Discuss aircraft survivability in relation to air defense threat, specific lethal weapons and exposure time during target engagements. Address in terms of tactics employed during various conflict environments and under consideration of relative air superiority. The comments will be included in the final Validation of Close Air Support Phase II Results report.

(5) Subjective Comments on the Contents of the Draft Final Report. Upon completion of the CAS Exercise Program, the JVH will distribute the draft final report to USREDCOM, LANTCOM and USEUCOM for review and comment. Comments will be returned to USREDCOM 45 days after date of the request for comments.

(6) Subjective Comments about Specific Points. These subjective comments will be requested by the JVH of appropriate unified commands on an as required basis. The unified commands may submit subjective comments as deemed appropriate.

4. UTILIZATION OF SUBJECTIVE COMMENTS.

a. Subjective comments submitted by the unified commands and commands sponsoring the exercises will not be modified by the JVH. All comments will be cataloged and appended to the CAS validation final report. Subjective comments will not be used to modify the quantitative data, however, they will be used to augment and clarify the quantitative data where applicable.

b. The subjective comments on the CAS Validation Objectives will be included in the final report.

c. Subjective comments on the other areas will be cataloged and appended to the final report. A summary of the comments will be included in the body of the report along with an acknowledgement. Where comments have been made relating to specific objectives, these will be included, as appropriate, in the discussion of the results.

d. A summary of the subject areas and timing of submissions is contained in Table B-1.

TABLE B-1

SUBMISSION REQUIREMENTS FOR SUBJECTIVE COMMENTS

Subjective Comment Area	Command	<u>USREDCOM</u>	<u>LANTCOM</u>	<u>USEUCOM</u>
1. About each training exercise.				
a. BRAVE CREW		30 days after termination		
b. EXPRESS CHARGER			30 days after termination	
c. BRAVE SHIELD IX		30 days after termination		
d. REFORGER 74				30 days after termination
e. CARAVAN III				30 days after termination
f. AGATE PUNCH			30 days after termination	
g. SOLID SHIELD 75			30 days after termination	
2. Apportionment and Allocation		60 days after termination of BRAVE CREW, and BRAVE SHIELD IX,		60 days after termination of REFORGER 74 and CARAVAN III
3. Test Objectives		90 days after termination of BRAVE CREW	90 days after termination of EXPRESS CHARGER	90 days after termination of REFORGER 74
4. Aircraft Survivability		45 days after termination of the last exercise (SOLID SHIELD 75)	45 days after termination of the last exercise (SOLID SHIELD 75)	45 days after termination of the last exercise (SOLID SHIELD 75)
5. Draft Final Report		45 days after review date request	45 days after review date request	45 days after review date request
6. Specific Points		As Required	As Required	As Required

ANNEX C

DATA COLLECTION

1. General. A plan of analysis for the CAS Validation Program was developed in Chapter 4. This plan includes a detailed dendritic tree of the analysis, where each CAS validation objective was subdivided into the required sub-objectives. The complexity of the objectives dictated the number of subobjectives required to achieve an answer to the stated CAS validation objectives. The pattern of analysis identified the data elements which will be required to answer the objective. This Annex will outline the type of data collection required, the necessary manual collection forms and a brief outline of the collection procedures.

2. Primary Data Collection Methods. The primary data collection means will be manual recording by data collectors. The data collectors will be highly qualified personnel. The manual data collection will be augmented by the Voice Recording System (VRS). Where gaps exist in the data or unexplainable inconsistencies exist in quantitative data from different sources, the VRS will be used to resolve the inconsistencies.

a. Data Collection Forms.

(1) The forms are intended to be completed by dedicated data collectors whose sole responsibility is the accurate collection of field data. The player personnel involved in the field/exercises will not be required to complete the data collection forms. The Joint Tactical Air Strike Request Form, amended as necessary, will be used at appropriate levels to request and process CAS missions. A copy of the form will be provided the CAS data collector at appropriate levels of command and control and will be attached to the CAS data collection form. USREDCOM/LANTCOM will modify these forms (as required) and publish specific forms to be used for field data collection on each exercise.

(2) A data collection package will be tailored for each data collection site so that the appropriate forms are readily available for field use. Packages will be structured on a daily/shift basis and will be picked up from the collection sites on a prescribed schedule.

3. Data Collection Problems. When problems arise where the data collection instructions are not adequate, the data collector should report the problem by the most expeditious means to his data collection phase team chief. In any event, he should continue to record data to the best of his capability until further direction is received from the Joint CAS Validation Headquarters.

4. Field Data Collection Procedures. Data collectors will complete the prescribed forms and questionnaires during specified observation periods for each exercise. The completed forms and questionnaires will be reviewed on site for completeness and accuracy by a data collection team chief or his representative. Should discrepancies be detected during this review, they will be corrected on site if possible. Subsequently, the completed forms and questionnaires will be delivered by the reviewer to the Joint CAS Validation Headquarters. The actions specified above will be accomplished within a time schedule as prescribed for each field exercise. Upon delivery, all forms/questionnaires will be reproduced immediately and copies will be provided to the Operations Analysis Team and the Data Reduction Team for immediate review and compilation of data. The Operations Analysis Team will determine the degree of accomplishment of planned CAS validation objectives attained during the observation time period, annotate any significant abnormalities in the data reviewed and, when necessary, make recommendations for immediate scenario influence required to insure accomplishment of planned objectives during subsequent exercise events. The Data Reduction Team will sort all data and prepare selected results for presentation to the Chief, Joint CAS Validation Headquarters. These procedures will be covered in detail at the Data Collectors' School preceding each field exercise.

APPENDIX I
ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR
IMMEDIATE CLOSE AIR SUPPORT - DATA FORM QUESTIONS
TO
ANNEX C
DATA COLLECTION

No. 1
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE REQUEST PHASE
BN, BDE, DIV OR CORPS (ORIGINAL REQUESTS ONLY)

1. Unit ID No. _____ 2. Location UTM Coordinates: _____
3. CAS Request No. _____ 4. Date (Day/Mo) _____ 197____
5. Tactical Situation: ☐ #1 Attack ☐ #2 Defense ☐ #3 Retrograde
6. Type Terminal Controller: ☐ #10 FAC(G) ☐ #11 FAC(A) ☐ #12 ASRT ☐ #16 Unknown
7. Time CAS Request Acknowledged by TACP: _____

Did Fire Support Coordination take place with the following elements?

☐ #5/G-3 Air ☐ Arty ☐ ADA ☐ Army AVN ☐ Naval Gun Fire

If not, Explain: _____

8. Time First Attempt to Transmit Request to: ☐ #4 DASC ☐ #9 Flt Ldr _____
9. Reason(s) for: ☐ #1 Delay ☐ #3 CNX, Between 7 & 8 Above: _____

10. Time CAS Request Acknowledged by: ☐ #4 DASC ☐ #9 Flt Ldr _____

11. Reason(s): ☐ #1 Delay ☐ #3 CNX Between 8 & 10 Above _____

12. Time of Cancellation, if Known: _____ Reason(s): _____

13. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____ Type: _____
Route: _____

14. Any Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #5 No Attempt
If Yes, Explain: _____

15. Remarks: _____

INSTRUCTIONS:

- A. If Alt Comm used more than once, use Remarks for each additional occurrence.
B. All times will be expressed in local time.
C. If additional space is required use back of page and identify question number.

DATA COLLECTOR'S NAME: _____

No. 2
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE REQUEST PHASE
BDE OR DIV (MONITOR ONLY)

1. Unit ID No: _____ 2. Location of TACP in UTM Coordinates: _____
3. CAS Request No: _____ 4. Date (Day/Mo) _____ 197 _____
5. Time CAS Request to DASC Monitored (End of Transmission) _____
6. Time Acknowledged by Monitoring Unit: _____
7. Time First Attempt to Transmit use of ☐ #1 Allocated ☐ #2 ARMY
Resources to DASC: _____
8. Time DASC Acknowledged Use of Allocated/Army Resources: _____
9. Time First Attempt to Transmit Execute Order to Flt Ldr: _____
10. Reason(s) for ☐ #1 Delay ☐ #2 Abort, Between 5 & 9. Above _____

11. Time Flt Ldr Acknowledges Execute Order: ☐ #1 Air Alert ☐ #2 Divert _____
12. Reason(s) for: ☐ #1 Delay ☐ #2 Abort, Between 9 & 11 Above _____

13. Time of ☐ #2 Abort or ☐ #3 Cancellation, if Known: _____
14. If Cancelled, Give Reason(s): _____

15. Time First Attempt to Transmit CNX to Initial Requestor: _____
16. Time ☐ #1 BN TACP / ☐ #2 BDE TACP Acknowledged CNX: _____
17. Reason(s) for delay between 15 and 16 above: _____

18. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
19. Any Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #3 Not Attempted
If Yes, Explain: _____
20. Remarks: _____

INSTRUCTIONS:

- A. If Alt Comm used more than once, use Remarks for each additional occurrence.
- B. All times are local times.
- C. Questions 7 through 20 used where CAS request disapproved, allocated resources or Army resources are utilized.
- D. If additional space is required, use back of page and identify question number.

DATA COLLECTOR NAME: _____

No. 3
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE REQUEST PHASE
ADJ, DIV OR CORPS (ALLOCATED RESOURCE ABORTS, ONLY)

1. Unit ID No: _____ 2. Location of TACP in UTM Coordinates: _____
3. CAS Request No: _____ 4. Date (Day/Mo): _____ 197__
5. New Mission Number: _____ 6. Time of Abort: _____
7. Old Mission Number: _____
8. Time: ☐#2 BDE TACP ☐#3 DIV TACP ☐#4 DASC Acknowledged Abort: _____
9. Reason(s) for Delay Between 6 and 8 Above: _____
10. Type of Resources Selected: ☐#1 Allocated ☐#2 Alert/Divert ☐#3 Army
If Army Resources Used, Skip to Question 19.
If Alert/Divert Resources Used, Answer 11 through 14.
If Allocated Resources Used, Answer 15 through 18.
11. Time First Attempt to Transmit Execute Order to New Flt Ldr: _____
12. Reason(s) for Delay, Between 8 and 11 Above: _____
13. Time Flt Ldr Acknowledged Execute Order: ☐#1 Air Alert ☐#2 Divert _____
14. Reason(s) for Delay Between 11 and 13 Above: _____
15. Time First Attempt to Request Allocated Resources: _____
16. Reason(s) for Delay Between 8 and 15 Above: _____
17. Time DASC Acknowledges Request for Allocated Resources: _____
18. Reason(s) for Delay Between 15 and 17 Above: _____
19. Time First Attempt to Transmit CNX Order to DASC: _____
20. Reason(s) for Delay Between 8 and 19 Above: _____
21. Time DASC Acknowledges Request: _____
22. Time First Attempt to Transmit CNX to Initial Requestor: _____
23. Reason(s) for Delay between 8 and 22 above: _____
24. Time ☐#1 BN TACP ☐#2 BDE TACP ☐#3 DIV TACP Acknowledges CNX: _____
25. a. Were Alternate Communications Used: ☐#1 Yes ☐#2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
26. Any Problems Communicating with Other Services: ☐#1 Yes ☐#2 No ☐#5 Not Attempted
If Yes, Explain: _____
27. Remarks: _____

INSTRUCTIONS:

- A. If Alt Comm Used more than once, use Remarks for each additional occurrence.
- B. If additional space is required, use back of page and identify question number.
- C. If relay through enroute control required, explain in Remarks.
- D. All times will be expressed in local.

DATA COLLECTOR NAME: _____

No. 4
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE REQUEST PHSE, DASC

1. DASC's Location in UTM Coordinates: _____ 2. CAS Request No.: _____
3. Date (Day/Mo) _____ 197__ 4. Mission No: _____
5. Flt Call Sign: _____
6. Time CAS Rqst from ☐ #1 Bn TACP ☐ #2 BDE TACP ☐ #3 DIV TACP ☐ 19 CORPS Ack'd _____
7. Time decision to use: ☐ DASC Resources ☐ TACC Resources _____
If TACC resource request, skip to 13.
8. Time First Attempt to Transmit Execute Order: _____
9. Reason(s) for: ☐ #1 Delay ☐ #2 Abort, Between 6 and 8 Above: _____

10. Time Order Acknowledged by: ☐ #5 TUOC ☐ #6 CRC ☐ #9 Flt Ldr: _____
11. If Airborne Resources Used, Mission was from: ☐ #1 Air Alert ☐ #2 Divert.
12. Reason(s) for: ☐ #1 Delay ☐ #2 Abort Between 8 and 10 Above: _____

13. Time First Attempt to Transmit Request for TACC Alert Resources: _____
14. Reason(s) for: ☐ #1 Delay ☐ #2 Abort Between 6 and 13 Above: _____

15. Time Request for TACC Alert Resources Acknowledged by TACC: _____
16. Reason(s) for: ☐ #1 Delay ☐ #2 Abort Between 13 and 15 Above: _____

17. Time of Abort, if known: _____
18. Time Abort Acknowledged by DASC: _____
19. If Aborted, Give New Mission Number: _____
20. Time DASC ack'd Cancellation of Request by: ☐ #2 BDE TACP ☐ #3 DIV TACP ☐ 19 CORPS _____
21. Give Reason(s) for CNX: _____

22. a. Were Alternate Communications Used: ☐ #1 YES ☐ #2 NO
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
23. Any Problems Communicating with Other Services: ☐ #1 YES ☐ #2 NO ☐ #5 Not attempted
If Yes, Explain: _____
24. Remarks: _____

INSTRUCTIONS:

- A. If additional space is required, use back of page and identify question number.
- B. If Alt Comm used more than once, use Remarks for each additional occurrence.
- C. All times will be expressed in local.

DATA COLLECTOR NAME _____

No. 5
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE LAUNCH SITE TUOC

1. Base: _____ 2. Date (Day/Mo): _____ 197
3. Strike Order Received From: ☐ #4 DASC ☐ #13 TACC ☐ #15 Other
4. Mission Number: _____ 5. Flt Call Sign: _____
6. Number and Type Aircraft: _____ 7. Alert Status (Mins) _____
8. Time Strike Order Acknowledged at TUOC: _____
9. Time First Attempt to Contact Flight Leader: _____
10. Reason(s) for: ☐ #1 Delay ☐ #3 CNX Between 8 and 9 Above: _____
11. Time Execute or Strike Order Acknowledged by Flight Leader: _____
12. Reason(s) for: ☐ #1 Delay ☐ #3 CNX Between 9 and 11 Above: _____
13. Were target instructions and FAC info given Flt Ldr: ☐ #1 Yes ☐ #2 No
14. Take Off Time (Lead Aircraft Wheels Up): _____
15. Reason(s) for: ☐ #1 Delay ☐ #2 Abort Between 11 and 14 Above: _____
16. Time: ☐ #2 Abort ☐ #3 CNX, if Known. _____
17. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
- b. If Yes, Time First Attempted: _____; Time Established: _____
- Type: _____; & Route: _____
18. Any Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
- If Yes, Explain: _____
19. Remarks: _____
- _____
- _____
- _____

INSTRUCTIONS:

- A. If Alt Comm used more than once, use Remarks for each additional occurrence.
- B. If additional space is required, use back of page and identify question number.
- C. All times will be expressed in local.

DATA COLLECTOR NAME: _____

No. 6
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE ENROUTE CONTROL, CRC, CRP, FACP

1. Unit/ID No.: _____ 2. Location in UTM Coordinates: _____
3. Date (Day/Mo) _____ 197 _____
4. Strike/Execute Order From: ☐ #4 DASC ☐ #3 TACC ☐ #6 CRC ☐ #7 CRP (1) ☐ #8 CRP (2)
5. Aircraft Source: ☐ #1 Gnd Alert ☐ #2 Air Alert ☐ #3 Divert ☐ #8 Unknown
6. Mission Number: _____ 7. Flt Call Sign: _____
8. Time of Acknowledgement of Strike/Execute Order: _____
9. Was a restricted fire plan in effect? ☐ #1 Yes ☐ #2 No
AIR ALERT/DIVERT answer 10 through 13, skip 14 through 17.
10. Time First Attempt to Transmit to Flt Ldr: _____
11. Reason(s) for ☐ Delay ☐ Abort between 8 and 10 above: _____

12. Time Flt Ldr Acknowledged: _____
13. Reason(s) for delay between 10 and 12 above: _____

- AIRBORNE GROUND ALERT MISSION answer 14 through 17.
14. Target instructions and FAC info given to Flt Ldr: ☐ #1 Airborne ☐ #2 Ground
15. Time communications established with Flt Ldr: _____
16. Time ☐ Abort ☐ CNX if Known: _____
17. Reason(s) for ☐ Abort ☐ CNX if Known: _____

18. Relay strike order to ☐ #7 CRP (1) ☐ #8 CRP (2) ☐ #9 FACP (1) ☐ #17 FACP (2)
☐ #12 ASRT ☐ #18 N/A
19. Time First attempt to transmit relay of strike/execute order: _____
20. Time of acknowledgement: _____
21. Reason(s) for delay between 19 and 20 above: _____

22. Time Flight Handed Off/Sent to: ☐ #7 CRP (1) ☐ #8 CRP (2) ☐ #9 FACP (1) ☐ #17 FACP (2)
☐ #19 FAC (G) ☐ #11 FAC (A) ☐ #12 ASRT
23. Did Flt Ldr Establish comm with your Enroute Control Unit After Release by FAC/ASRT:
☐ #1 Yes ☐ #2 No If Yes, state time: _____
24. Time Flt Ldr Acknowledged instructions to: ☐ #1 Return to Base ☐ #2 Go to Air Alert
☐ Divert to New CAS Mission _____
25. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time first attempted: _____; Time Established: _____
Type: _____; & Route: _____
26. Any problems communicating with other Services: ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
If Yes, Explain: _____

27. Remarks: _____

INSTRUCTIONS:

- A. If Alt Comm used more than once, use Remarks for each additional occurrence.
- B. If additional space is required, use back of page and identify question number.
- C. All times will be expressed in local.

DATA COLLECTOR NAME: _____

No. 7
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE REQUEST PHASE, TACC

1. TACC Call Sign: _____ 2. Base/Site Location: _____
3. CAS Request No: _____ 4. Date (Day/Mo): _____ 197__
5. Mission No: _____ 6. Flt Call Sign: _____
7. Time CAS Request Acknowledged by TACC (Intervene or additional resources): _____
8. Source of Mission: ☐ #2 Air Alert ☐ #1 Gnd Alert ☐ #3 Divert
9. Time First Attempt to Transmit Strike Order: _____
10. Reason(s) ☐ #1 Delay ☐ #2 Abort Between 7 and 9 Above: _____
- _____
- _____
11. Time Strike Order Acknowledged by: ☐ #5 TUOC ☐ #6 CRC * _____
12. Reason(s): ☐ #1 Delay ☐ #2 Abort Between 9 and 11 Above: _____
- _____
- _____
13. Time of: ☐ #2 Abort or ☐ #3 CNX, if Known: _____
14. Time (s) ☐ #2 Abort ☐ #3 CNX Acknowledged by / ☐ #4 DASC ☐ #13 TACC: _____
15. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
- b. If Yes, Time First Attempted: _____; Time Established: _____
- Type: _____; & Route: _____
16. Any problems communicating with other Services: ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
- If Yes, Explain: _____
17. Remarks: _____
- _____
- _____
- _____

INSTRUCTIONS:

- *A. For TACC Resources Only:
- B. If Alt Comm used more than once, use Remarks for each additional occurrence.
- C. If additional space is required, use back of page and identify question number.
- D. All times will be expressed in local.

DATA COLLECTOR NAME: _____

No. 8
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY/AIR FORCE TERMINAL AREA, ASRT

1. Unit ID No. _____ 2. Location UTM Coordinates: _____
3. No. & Type Acft _____ 4. Date (Day/Mo) _____
5. Mission No. _____ 6. Call Sign: _____
7. Source of Mission (if known): ☐ #1 Gnd Alrt ☐ #2 Air Alert ☐ #3 Divert ☐ #7 Other

8. Target Briefing Received From: _____ Time: _____
9. Time of Handoff From: ☐ #6 CRC ☐ #7 CRP (1) ☐ #8 CRP (2) ☐ #15 Other
10. Time Atck Acft Locked on by ASRT: _____
11. Reason(s) for ☐ #1 Delay ☐ #2 Abort, between 9 & 10 above

12. Time Flt Ldr 20 KM from Tgt: _____
13. Time final clearance received by ASRT from: ☐ #4 DASC ☐ #13 TACC ☐ #15 Other
14. Reason(s) for ☐ #1 Delay ☐ #2 Abort, between 12 & 13. _____

15. Time Flt Ldr directed to arm weapons: _____
16. Time of weapons release: _____
17. Reason(s) for ☐ #1 Delay ☐ #2 Abort between 13 & 16 above

18. Time Flt Ldr Acknowledges Release from ASRT to: ☐ #2 Air Alert ☐ #3 Divert
☐ #6 Return to Base ☐ #8 Unknown _____
19. Time ☐ #2 Abort ☐ #3 Cancellation, if known: _____
20. Reason(s) if cancelled: _____

21. Time Flight Leader acknowledges receipt of new mission, if known: _____
22. Target Description, if known: _____ WX at Tgt, if Known (Ceiling/Vis) _____
23. a. Were alternate communications used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
24. Any problems communicating with other services: ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
If Yes, Explain: _____
25. Remarks: _____

INSTRUCTIONS:

- A. If Additional space is required, use back of page and identify question number.
- B. If Alt Comm used more than once, use Remarks for each additional occurrence.
- C. All times will be express in local.

DATA COLLECTOR NAME: _____

No. 9
ARMY/AIR FORCE CAS COMMAND AND CONTROL
DATA FORM QUESTIONS, FAC DEBRIEFING

1. Supported Unit ID No.: _____ 2. FAC Loc UTM: ☐#1 FAC(A) ☐#2 FAC(G) _____
3. CAS Rqst No. (If Known) _____ 4. Date (Day/Mo) _____ 197__
5. Mission No. _____ 6. No. & Type Acft: _____ 7. Call Sign: _____
8. Source of Mission: ☐#1 Gnd Alert ☐#2 Air Alert ☐#3 Divert ☐#7 Other _____ ☐#8 Unk _____
9. Terminal Control: ☐#10 FAC(A) ☐#11 FAC(G) 10. Terminal Ctrlr Call Sign: _____
11. Time Flt Ldr Established Comm with FAC: _____
12. Time acknowledged that Atk Acft is at Rendezvous/Control Point: _____
13. Reason Codes for: ☐#1 Delay ☐#2 Abort, Between 11 and 12 Above: _____
14. Location Rendezvous/Control Point: _____
(DME/Bearing _____ / _____ Station _____ or UTM)
15. Time Flt Ldr Reports Tgt/Ref Point in Sight: _____
16. Reason Codes for ☐#1 Delay ☐#2 Abort Between 12 and 15 above: _____
17. Time Flt Ldr Acknowledges Clearance to Attack: _____
18. Reason Codes for: ☐#1 Delay ☐#2 Abort Between 15 and 17 Above: _____
19. Time Flt Ldr Reports First Weapons Release (Pickle Time): _____
20. Reason Codes for: ☐#1 Delay ☐#2 Abort Between 17 and 19 Above: _____
21. No. Acft Under Control of FAC When Flt Came Under Control: _____, was Ordered to Hold _____
or Aborted Mission _____
22. Target Location/Description: _____
23. Tgt Mark Method: ☐#1 Smoke ☐#2 Laser ☐#3 Visual ☐#4 Other _____
24. Time of: ☐#2 Abort ☐#3 Cancellation _____
25. Was a Restricted Fire Plan in Effect? ☐#1 Yes ☐#2 No
26. Reason Codes, if Cancelled: _____

#1 Comm Security	#7 Int'rm't Comm	14 ATC Coord	20 Frndly Loc Info	26 Insuf Fuel
#2 ECM	#8 Fire Spt Coord	15 C&C Elem Cap	21 Enmy Posn Info	27 Red Smoke
#3 Authn Procd's	#9 Air Def Coord	16 WX Conditions	22 Inacc Tgt Info	28 Enemy Air Acty
#4 Comm Satur't'n	#10 Airspace Coord	17 Tgt ID-Flt Ldr	23 Atk Acft Mal	29 Admin Hold
#5 RF Interfer	12 Gnd Authn Clns	18 Lost Tgt-FAC	24 Ctrlr Out Posn	30 Other _____
#6 Comm Incompat	13 Safety	19 C&C Elem Malf	25 Atk Acft Posn	
27. Wx at Tgt (Ceil/Vis) _____ 28. Terrain Tgt Area: ☐#1 Open ☐#2 Cluttered
29. Time Flt Ldr Acknowledges Release From FAC: _____, for ☐#2 Air Alert ☐#3 Divert
☐#6 RTB ☐#8 Unknown
30. Time Flt Ldr Acknowledges Receipt of New Mission, if Known: _____
31. a. Were Alternate Communications Used? ☐#1 Yes ☐#2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
32. Any problems communicating with other Services: ☐#1 Yes ☐#2 No ☐#5 Not Attempted
If Yes, Explain: _____
33. Remarks: _____

No. 10
ARMY/AIR FORCE CAS COMMAND & CONTROL
DATA FORM QUESTION, AIRCREW DEBRIEFING

1. WG/SQ ID: _____ 2. Takeoff Base: _____ 3. Date (Day/Mo) _____ 197__
4. Call Sign _____ 5. No. & Type Acft _____ 6. Mission No. _____
7. Source of Mission: ☐ #1 Gnd Alert ☐ #2 Air Alert ☐ #3 Divert ☐ #7 Other _____
8. CAS execute order received from: _____
9. Air Alert Orbit/Divert Locations: 1st _____ 2nd _____
10. Describe any Extensive Route Deviations From: ☐ #1 Base ☐ #2 Air Alert Orbit Point ☐ #3 Divert Pt to Control Point _____
11. Method of Acquiring Target: ☐ #1 Visual ☐ #2 Laser Tracker ☐ #3 Infrared ☐ #4 Radar ☐ #5 Gnd Directed ☐ #6 Other _____
12. Target Location/Description: _____
 - a. Were other tgts worked in same area with same controller: ☐ Yes ☐ No (N/A if new request number)
 - b. If yes, give tgt location and description: _____
13. Wx at Tgt (Ceil/Vis) _____ 14. Terrain Tgt Area: ☐ #1 Open ☐ #2 Cluttered
15. If cluttered, was there: ☐ #1 Delay ☐ #2 Abort ☐ #3 CNX, because of ☐ #1 Altered Attack Approach ☐ #2 Masked Reference Mark/Target ☐ #3 Other _____? ☐ #1 Yes ☐ #2 No
16. For mission tracking purposes, state sequence of events from a CAS execute order receipt until release from this terminal controller. (Include aborts and cancellations.) _____

17. Degradation Due to Communications:

a. Enroute Control (Ingress and Egress)

	Facility	Call Sign	Delay	Abort	CNX	N/A	Reason Codes
1st	_____	_____	_____	_____	_____	_____	_____
2nd	_____	_____	_____	_____	_____	_____	_____
3rd	_____	_____	_____	_____	_____	_____	_____
4th	_____	_____	_____	_____	_____	_____	_____
5th	_____	_____	_____	_____	_____	_____	_____

b. Terminal Area Control (FAC(G), FAC(A), or ASRT)

	Type Control	Call Sign	Delay	Abort	CNX	N/A	Reason Codes
1st	_____	_____	_____	_____	_____	_____	_____
2nd	_____	_____	_____	_____	_____	_____	_____

#1 Comm Security	#7 Int'rmt Comm	14 ATC Coord	2# Frndly Loc Info	26 Insuf Fuel
#2 ECM	#8 Fire Spt Coord	15 C&C Elem Cap	21 Enemy Posn Info	27 Red Smoke
#3 Authn Procd's	#9 Air Def Coord	16 WX Conditions	22 Inacc Tgt Info	28 Enemy Air Acty
#4 Comm Satur't'n	#10 Airspace Coord	17 Tgt ID-Flt Ldr	23 Atk Acft Malf	29 Admin Hold
#5 RF Interfer	12 Gnd Auth Cinc	18 Lost Tgt-FAC	24 Ctrlr Out Posn	3# Other
#6 Comm Incompat	13 Safety	19 C&C Elem Malf	25 Atk Acft Posn	

18. After ☐ Abort or ☐ Release from Terminal Controller, was Alternate Comm required to report Abort or Establish Enroute Control? ☐ #1 Yes ☐ #2 No.
19. Did the Flt Ldr: ☐ Receive a New Mission; ☐ Assume Air Alert; ☐ Return to Base?
20. Landing Time _____ 22. Was an Alternate terminal controller required? ☐ #1 Yes ☐ #2 No
21. Any problems communicating with other services? ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
If Yes, Explain: _____

22. Remarks: _____

INSTRUCTIONS:

- A. If ECM encountered, state time and details in Remarks.
- B. If additional space required, use back of page and identify question number.

DATA COLLECTOR NAME: _____

No. 11
ARMY/AIR FORCE CAS COMMAND AND CONTROL
UNIVERSAL DATA COLLECTOR DAILY (SHIFT) QUESTIONNAIRE

1. Reporting Period _____ hours to _____ hours. 2. Date (Day/Mo) _____ 197 _____
3. C&C Element: ☐ #1 BN TACP ☐ #2 BDE TACP ☐ #3 DIV TACP ☐ #4 DASC ☐ #5 TUOC
☐ #6 CRC ☐ #7 CRP (I) ☐ #8 CRP (II) ☐ #9 FAC (A) ☐ #11 FAC (G) ☐ #12 ASRT ☐ #13 TACC
☐ #16 FACP (1) ☐ #17 FACP (2) 4. Element ID No. _____
5. Did your C&C element change location during your shift? ☐ #1 Yes ☐ #2 No ☐ #4 N/A*
6. If Yes, list duration of moves: a. 1st Move _____ hrs to _____ hrs. b. 2nd Move _____ hrs to _____ hrs c. 3rd Move _____ hrs to _____ hrs.
7. List the new equipment and the equipment that was replaced
- | | |
|------------|-----------------|
| New: _____ | Replaced: _____ |
| New: _____ | Replaced: _____ |
| New: _____ | Replaced: _____ |
| New: _____ | Replaced: _____ |
8. Were there any communications problems during your shift, not reported on mission forms, which adversely affected CAS C&C responsiveness? ☐ #1 Yes ☐ #2 No. If Yes, Explain _____
9. Were there other problems during your shift which seriously detracted from CAS C&C responsiveness? ☐ #1 Yes ☐ #2 No. If Yes, Explain: _____
10. Remarks: _____
- _____
- _____
- _____
- _____
- _____

* A. Not Applicable for FAC's.

B. If additional space is required, use back of page and identify question number.

DATA COLLECTOR NAME _____

FAC WORKSHEET			
FAC CALL SIGN:			
DATE:	FAC LOC:	REQUESTING UNIT ID:	
REQUEST NO:		MSN NO:	
TGT COORD:		TERRAIN:	
TGT DESCRIPTION:			
TGT WX:		TACTICAL SITUATION:	
FTR NO/TYPE CALL SIGN:		COMM EST & TIME:	<u>PRIM</u> <u>ALT</u>
ATK ACFT RENDEZVOUS/ CONTROL PT ARRIVAL TIME:			
RENDEZVOUS/CONTROL POINT LOCATION:		NEW EQUIPMENT YES NO	
TIME TGT/REF POINT IN SIGHT		RESTR FIRE PLAN YES NO	
TGT MARK METHOD:		RE-MARK METHOD:	
TIME CLEARANCE TO ATK, ACK'D:			
1st WEAPONS RELEASE TIME:		ATTACK COMP TIME:	
FTRS RELEASE TIME:		TO:	
TIME FTRS ABORT:		OR CNX:	
DELAYS:			
REMARKS:			

APPENDIX II
ARMY COMMAND AND CONTROL NETWORK
FOR
ATTACK HELICOPTER CAS - DATA FORM QUESTIONS
TO
ANNEX C
DATA COLLECTION

No. 1-2-3-4-5.-6*

CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY ATTACK HELICOPTER
REQUEST PHASE (CO, BN, BDE, DIV, CORPS CONTROL ELEMENT)

1. Unit/Element ID: _____ 2. Location (Grid): _____
3. Date (Day/Mo/Yr): _____ 197__ 4. Tac Situation: ☐ #1 Atk ☐ #2 Def ☐ #3 Retro
5. CAS Requestors ID (Unit/Element/Call Sign): _____ ☐ New Request ☐ Abort/CNX
6. Tgt Loc (Grid/Other): _____ 7. Tgt Description: _____
8. Special Ordnance Requested: ☐ #1 Yes ☐ #2 No. If Yes, Type: _____
9. Type Terminal Controller: ☐ #1 Ground ☐ #2 Air ☐ #3 Unknown
10. Terminal Controller ID (Unit/Call Sign): _____
11. Time Request/Order Acknowledged: _____ or Request/Order Originated in Control Element: _____
12. Time Decision Announced Concerning this Request /Order: _____
Time Request/Order Coordinated: _____ FSC Unit/Call Sign: _____
Did Fire Support Coordination take place with the following elements?
☐ ALO ☐ ARTY ☐ ADA ☐ Army Avn ☐ Naval Gun Fire
If not, Explain: _____
13. Nature of Decision: ☐ #1 Approve Request - Use FW CAS; ☐ #2 Approve Request - Use AH;
☐ #3 Disapprove Request - Provide No Support; ☐ #4 Disapprove Request - Support with Field
Artillery or Other Maneuver Unit. ☐ #5 OTHER: (Specify) _____
14. Time First Attempt to Transmit CAS Request/Order to: _____ Time: _____
☐ #1 Supporting AH AVN Ops/Launch Site/Flt Ldr; ☐ #2 Airborne Supporting AH Flt Ldr;
☐ #3 Other Echelon TOC; ☐ #4 Supporting TACP: Specify Mission Request Number: _____
15. Time CAS Request/Order Acknowledged: _____
16. Identify Element Transmitted to in Questions 14 and 15 (Unit ID/Call Sign): _____
17. Specify Reasons for: ☐ #1 Delay ☐ #3 CNX, Between 11 and 14 Above: _____
18. Specify Reasons for: ☐ #1 Delay ☐ #3 CNX Between 14 and 15 Above: _____
19. Time of Cancellation /Disapproval and Element Cancelling/Disapproving Request/Order: _____
Element (ID/Call Sign): _____
20. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
c. Specify Reasons for use: _____
21. Were there Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #3 Not Attempted
If Yes, Explain: _____
22. Remarks: _____

- * No. 1 - CO
2 - BN
3 - BDE
4 - DIV
5 - CORPS
6 - FDC

DATA COLLECTOR: _____ ROSTER NUMBER: _____

NO. 7-8-9-10-11-12*
CAS COMMAND AND CONTROL DATA FROM QUESTIONS
ARMY ATTACK HELICOPTER
REQUEST/EXECUTION PHASES (LAUNCH SITE/AVNOPS: CO, BN, BDE, DIV, CORPS)

1. Unit/Element ID: _____ 2. Location (Grid): _____
3. Date (Day/Mo/Yr): _____ 4. Attack Helicopter Unit/Element Tactical Mission Assignment/OPCON Status: _____
5. Launch Order Received From: ☐ CO ☐ BN ☐ BDE ☐ DIV ☐ CORPS ☐ OTHER
Specify Unit/Element/ID Call Sign: _____ ☐ NEW REQUEST ☐ ABORT RECYCLE
6. Alert Status (Mins): _____
7. WX at Launch Site (Ceil/Visability): _____
8. Target Location (Grid/Other): _____ 9. Target Description: _____
10. Enroute Controller/Coordinator (If Known give Unit/Element ID/Call Sign): _____
11. Type Terminal Controller: ☐ #1 Ground ☐ #2 Air ☐ #3 Unknown
12. Terminal Controller ID (Unit/Call Sign): _____
13. Time Launch Order Acknowledged at Launch Site/AVNOPS: _____
14. Time First Attempt to Contact Flight Leader: _____
15. Specify Reasons for: ☐ #1 Delay ☐ #3 CNX Between 13 & 14 Above: _____
16. Flight Call Sign: _____ 17. No. & Type Acft in Flight: _____
18. Time Launch Order Acknowledged by Flight Leader: _____
19. Specify Reasons for: ☐ #1 Delay ☐ #3 CNX Between 14 & 18 Above: _____
20. Takeoff Time (Lead Aircraft Skids Off Ground): _____
21. Specify Reasons for: ☐ #1 Delay ☐ #2 Abort ☐ #3 CNX Between 18 & 20 Above: _____
22. Time: ☐ #2 Abort ☐ #3 CNX if Known: _____; Specify Reason(s) and ID of Elements Involved: _____
23. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; and Route: _____
24. Any Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
If Yes, Explain: _____
25. Remarks: _____

* NO. 7 - CO
8 - BN
9 - BDE
10 - DIV
11 - CORPS
12 - AFA

DATA COLLECTOR: _____ ROSTER NUMBER: _____

NO. 13
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY ATTACK HELICOPTER
EXECUTION PHASE (ENROUTE CONTROL: FOC, FCC, ECHELON TOC)

1. Unit/Element ID: _____ 2. Location (Grid): _____
3. Date (Day/Mo/Yr): _____ 4. Mission Acft/Flt Ldr Call Sign: _____
5. Initial Mission Info Rcvd From: ☐ #1 Mission Acft ☐ #2 Other Flight Operations Elem
☐ #3 Other TOC Elem ☐ #4 Other Acft; Identify Unit/Call Sign: _____
6. Number and Type of Acft in Flight: _____
7. Time Radio Contact Established Between Enroute Control Elem & Mission Acft: _____
8. Number of Additional Flights Under Control/Coordination/Advisory Assistance at Time Contact
Established with Mission Acft: _____
9. Time Enroute Control Service Terminated/Passed to Next Control Element: _____
Identify Next Control Agency (Unit/Call Sign): _____
10. Time Abort Info Received from Mission Acft/Flight Leader: _____
11. Time Abort Info Passed to: Time: _____ ☐ #1 AH Aviation Unit ☐ #2 CAS Mission Requestor
☐ #3 Other: Specify Unit ID/Call Sign: _____
12. Time CAS Mission Cancellation Info Received From: Time: _____; Unit ID/Call Sign of Element
Cancelling Mission: _____
13. Time CAS Mission CNX Info Acknowledged by Flight Ldr: _____
14. Specify Reasons for Cancellation, if Applicable and Known: _____
15. Did Flt Ldr Establish Comm with Enroute Control After Release by Terminal Cntrlr: ☐ #1 Yes ☐ #2 No
16. Time Flt Ldr Acknowledges Receipt of New CAS Mission (If Applicable): _____
17. New Mission: Target Location _____ Target Description _____
Contact Call Sign: _____
18. Did Flt Ldr Acknowledge Instructions to: ☐ #1 Return to Base ☐ #2 Go to Air Alert.
☐ #1 Yes ☐ #2 No ☐ #3 Unknown ☐ #4 N/A.
19. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; Route: _____
20. Any Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #5 Not attempted
If Yes, Explain: _____
21. Remarks: _____

DATA COLLECTOR: _____

ROSTER NUMBER: _____

NO. 14
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY ATTACK HELICOPTER
EXECUTION PHASE (TARGET AREA: GROUND OR AIR CONTROLLER)

1. Unit/Element ID: _____ 2. Location (Grid): _____
 3. Date (Day/Mo/Yr): _____ 4. Data Collector Location (Air): _____
 5. Target Location and Description: _____
 6. Attack Helicopter(s) Call Sign: _____
 7. Number and Type Aircraft: _____
 8. Source of Mission: ☐ #1 Ground Alert ☐ #2 Air Alert ☐ #3 Divert ☐ #7 Unknown ☐ #8 Other
Specify: _____
 9. Terminal Control: ☐ #1 Gnd Cmdr/Rep ☐ #2 Helicopter Pilot/Obsvr ☐ #3 Other: _____
 10. Terminal Controller Call Sign: _____
 11. Time Flight Leader Established Comm w/Primary Terminal Controller: _____
 12. Time Flight Leader Established Comm w/Alternate Terminal Controller: _____
 13. Specify Reason/s for ☐ #1 Delay ☐ #2 Abort Between 11 & 12 Above: _____
 14. Time Terminal Controller First Sighted or Identified Lead Aircraft: _____
 15. Specify Reasons for: ☐ #1 Delay ☐ #2 Abort, Between 11 or 12 & 14 Above: _____
 16. Time Flt Ldr Reports Tgt/Ref Pt in Sight: _____
 17. Specify Reasons for: ☐ #1 Delay ☐ #2 Abort, Between 14 & 16 Above: _____
 18. Time Flt Ldr Acknowledges Clearance to Attack: _____
 19. Specify Reasons for: ☐ #1 Delay ☐ #2 Abort, Between 16 & 18 Above: _____
 20. Time Flt Ldr Reports First Ordnance Release: _____
 21. Specify Reasons for: ☐ #1 Delay ☐ #2 Abort, Between 18 & 20 Above: _____
 22. No. Additional Runs: _____ Final Ordnance Release Time: _____
 23. No Acft Under Control of Ctlr When Flt Came Under Control _____, was Order to Hold:
_____ or Aborted Mission _____
 24. Tgt Mark Method: ☐ #1 Smoke ☐ #2 Laser ☐ #3 Visual ☐ #4 Other _____
 25. Time of: ☐ #2 Abort ☐ #3 Cancellation: _____
 26. Specify Reasons if Cancelled or Aborted: _____
 27. Wx at Tgt (Ceil/Vis) _____ 28. Terrain Tgt Area: ☐ #1 Open ☐ #2 Cluttered
 29. Time Flt Ldr Acknowledges Release From Ctlr: _____, for ☐ #2 Air Alert: ☐ #3 Divert;
☐ #6 RTB ☐ #8 Unknown.
 30. Time Flt Ldr Acknowledges Receipt of New Mission, if Known: _____
 31. a. Were Alternate Communications Used? ☐ #1 Yes ☐ #2 No
b. If Yes, Time First Attempted: _____; Time Established: _____
Type: _____; & Route: _____
 32. Any Problems Communicating with Other Services: ☐ #1 Yes ☐ #2 No ☐ #5 Not Attempted
If Yes, Explain: _____
 33. Remarks: (Use Reverse Side) _____
- DATA COLLECTOR: _____ ROSTER NUMBER: _____

NO. 15
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY ATTACK HELICOPTER
REQUEST/EXECUTION PHASE (AIRCREW DEBRIEFING)

1. Unit ID: _____ 2. Location (Grid) Launch Site: _____
3. Date (Day/Mo/Yr) _____ 4. No. & Type Acft: _____
5. Call Sign(s): _____
6. Target Location and Description: _____
7. Source of Mission: ☐ #1 Gnd Alert ☐ #2 Air Alert ☐ #3 Divert ☐ #7 Other (Specify): _____
8. Time Launch/Execute Order Acknowledged by Flight Leader: _____
9. Flight Leader Location at Time Execute Order Received: _____
10. Describe any Extensive Route Deviations From: ☐ #1 Base ☐ #2 Air Alert Orbit Point
☐ #3 Divert Point to Terminal Area Control Point: _____
11. Method of Acquiring Target: ☐ #1 Visual ☐ #3 Infrared (Cavnav) ☐ #4 Radar
☐ #5 Gnd Directed ☐ #6 Other: _____
12. Number of Runs This Request/Mission: _____
13. Specify Reason(s) If More than One: _____
14. Ordnance Load on Board at the Start of this Request/Mission: _____
15. WX at Tgt (Ceil/Vis): _____ 16. Terrain in Tgt Area: ☐ #1 Open ☐ #2 Cluttered
17. If Cluttered, Was there: ☐ #1 Delay ☐ #2 Abort ☐ #3 CNX, Because of: ☐ #1 Altered Attach
Approach ☐ #2 Masked Reference Point/Target ☐ #3 Other: _____
☐ #1 Yes ☐ #2 No
18. State sequence of events by C&C element and operational function from ingress enroute control to completion of a mission or RTB (Include Aborts and Cancellations): _____
19. Degradation Due to Communications:
 - a. Enroute Control (Ingress and Egress)

Facility	Call Sign	Delay	Abort	CNX	N/A	Specify Reason/s
1st _____	_____	_____	_____	_____	_____	_____
2nd _____	_____	_____	_____	_____	_____	_____
3rd _____	_____	_____	_____	_____	_____	_____
 - b. Type Control

Type Control	Call Sign	Delay	Abort	CNX	N/A	Specify Reason/s
1st _____	_____	_____	_____	_____	_____	_____
2nd _____	_____	_____	_____	_____	_____	_____
20. After ☐ Abort or ☐ Release from Terminal Controller, Was Alternate Comm Required to report Abort or Establish Enroute Control? ☐ #1 Yes ☐ #2 No
21. Did Flt Ldr receive new mission: ☐ #1 Yes ☐ #2 No. If Yes, Give Tgt Locus/Description: _____
22. Landing Time: _____ 25. Was an Alternate Controller Required? ☐ #1 Yes ☐ #2 No
23. Any Problems Communicating with Other Services? ☐ #1 Yes ☐ #2 No ☐ #5 Not attempted
If Yes, Explain: _____
4. Remarks: (Use Reverse Side) _____

DATA COLLECTOR: _____ ROSTER NUMBER: _____

NO. 16
CAS COMMAND AND CONTROL DATA FORM QUESTIONS
ARMY ATTACK HELICOPTER
REQUEST/EXECUTION PHASES (DAILY SHIFT QUESTIONNAIRE)

1. Unit/Element ID: _____ 2. Location(Grid): _____
3. Date (Day/Mo/Yr): _____. Did the unit/element you are observing move to a new location during this period of observation? ☐ #1 Yes ☐ #2 No
If Yes, give old and new grid coordinates: Old: _____ New: _____
If Yes, give time move commenced and time operational in new location:
Time Commenced: _____ Time Operational: _____
4. Was there a change in tactical mission, attachment, or OPCON status of the unit/element you are observing during this period of observation? ☐ #1 Yes ☐ #2 No
If yes, identify both old and new mission/attachment/OPCON status.
Old: _____
New: _____
Time of Change: _____
5. Were there any unusual circumstances or problems affecting the performance of command and control for CAS which were not specified in the data collection forms provided? ☐ #1 Yes ☐ #2 No
If Yes, Describe: _____
6. Were there any significant periods of time during which you were unable to observe/gather data? ☐ #1 Yes ☐ #2 No. If yes, specify time period(s) and reason(s) for inability to serve.

7. Were there any periods of time during which you were unable to communicate with CAS Validation Headquarters? ☐ #1 Yes ☐ #2 No If yes, specify time period(s) and known or suspected reasons for inability to communicate: _____

8. Other Comments: _____

- Data Collector: _____ Roster Number: _____

NO. 17

CAS COMMAND AND CONTROL
DAILY/SHIFT QUESTIONNAIRE
INDICATORS OF CONSISTENCY

UNIT/ELEMENT ID: _____ OBSERVATION PERIOD (DTG to DTG) _____

- 1 - Consideration of request/mission processing including decision making.

Yes ☐ No ☐ If no, explain why. _____

- 2 - Consideration of friendly ground operation.

Yes ☐ No ☐ If no, explain why. _____

- 3 - Consideration of flight techniques and procedures.

Yes ☐ No ☐ Not applicable ☐ If no, explain why. _____

- 4 - Consideration of level of activity played.

Yes ☐ No ☐ If no, explain why. _____

- 5 - Consideration of fire support coordination.

Yes ☐ No ☐ If no, explain why. _____

- 6 - Consideration of airspace coordination.

Yes ☐ No ☐ If no, explain why. _____

- 7 - Consideration of enemy air operations.

Yes ☐ No ☐ If no, explain why. _____

- 8 - Consideration of air defense coordination.

Yes ☐ No ☐ If no, explain why. _____

- 9 - Consideration of enemy air defense operations.

Yes ☐ No ☐ If no, explain why. _____

REMARKS: (Include continuation of comments requested above. Use reverse side if necessary.)

DATA COLLECTOR NAME: _____

APPENDIX III
NAVY/MARINE CORPS COMMAND AND CONTROL
SYSTEM FOR CAS - DATA QUESTION FORMS
TO
ANNEX C
DATA COLLECTION

This appendix contains the Navy/Marine Corps data collection form questions to be utilized in the CAS validation exercises for the collection of immediate CAS mission-related data. Eleven data collection forms will be utilized which are as follows:

- Form 1 - Forward Air Controller (FAC)
- Form 2 - Fire Support Coordination Center (FSCC)
- Form 3 - Direct Air Support Center (DASC)
- Form 4 - Tactical Air Command Center (TACC)
- Form 5 - Launch Location
- Form 6 - Tactical Air Operations Center (TAOC)
- Form 7 - Air Support Radar Team (ASRT)
- Form 8 - Airborne Controllers, FAC(A) TAC(A)
- Form 9 - Pilot/Flight Leader Debrief Form
- Form 10 - Supporting Arms Coordination Center (SACC)
- Form 11 - Tactical Air Control Center (TACC) (Afloat)

When control is afloat, forms 1, 2, 5, 7, 8, 9, 10 and 11 would be utilized during an exercise. In the case where control is ashore, form 1 through 9, inclusive, would be utilized.

DATA COLLECTION FORM # 1
FORWARD AIR CONTROLLER (FAC)
NAVY/MARINE CORPS CAS SYSTEM

Date: _____

[1] FAC Call Sign: _____ [2] Location: _____ [3] Unit/FAC Request Number: _____
(Coordinates)
[4] Mission of Ground Unit: _____ [5]a. Target Description: _____
[5]b. Target Location: _____ [5]c. Target Area Weather: _____
(Coordinates) (Ceiling and Visibility)

[6] Time Ground Commander directed FAC to Request CAS: _____ [7]a. TIME FAC first attempted to transmit
CAS Request: _____ [7]b. TIME actual transmission began: _____
[8]a. Was there a delay between 6 and 7a ? NO YES. If YES, duration and reason: _____
b. Was there a delay between 7a and 7b ? NO YES. If YES, duration and reason: _____
[9] Call Sign of agency to whom CAS request was passed: _____
[10] TIME FAC confirmed "good copy" of TAR to receiving agency: _____

[11]a. Communications Net used: _____ [11]b. Frequency Band: VHF HF UHF Other _____
(Net Name) (Specify)

[12] Was there a delay between 7b and 10 ? NO YES. If YES, duration and reason: _____

[13] Request was APPROVED / DISAPPROVED by _____ at _____
(circle one) (call sign) (Time)
[14] Mission/Event Number assigned: _____ [15]a. Aircraft Call Sign: _____
[15]b. Number and Type of Aircraft: _____ [16] Final Control Agency: FAC ASRT RABFAC FAC(A) TAC(A)
(Circle One)

[17] Was request/mission cancelled by ground unit after approval? NO YES. If YES, Time and reason: _____

[18] TIME two way communications established between FAC and aircraft: _____
[19] Time FAC sighted aircraft: _____, or Aircraft identified beacon: _____
(visual mission) (RABFAC mission)
[20] Was there a delay between 18 and 19 ? NO YES. If YES, duration and reason: _____
[21] Was the target marked? NO YES. If yes, at what TIME _____ HOW? _____
[22] TIME aircraft reported target / mark / reference point in sight: _____
[23] Was there a delay between 21 and 22 ? NO YES. If YES, duration and reason: _____
[24] TIME aircraft acknowledged clearance("cleared hot") to attack designated target: _____
[25]a. TIME first ordnance released: _____ [25]b. Time last ordnance released: _____
[25]c. Total number of runs (all aircraft) made on the target: _____

[26] Was there a delay between 24 and 25a ? NO YES. If YES, duration and reason: _____

[27] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK _____ SSN _____
Last Name First Initial

DATA COLLECTION FORM # 2
FIRE SUPPORT COORDINATION CENTER (FSCC)
NAVY/MARINE CORPS CAS SYSTEM

Date: _____

[1] FSCC Call Sign: _____	[2] Location: _____ (Coordinates)	[3] Unit/FAC Request Number: _____
[4] Call Sign of Requesting Unit: _____	[5] Request was: MONITORED RECEIVED FOR RELAY . (Circle one)	
[6] Net on which request was monitored/received for relay: _____ (Name of net)	Frequency: HF VHF UHF (circle one)	

[7] IF REQUEST WAS RECEIVED FOR MONITOR ONLY: a. Call Sign of receiving agency: _____
b. TIME FAC confirmed good copy of TAR to receiving agency: _____

[8] IF REQUEST WAS RECEIVED FOR RELAY: a. TIME requesting unit confirmed a good copy of TAR: _____		
b. TIME FSCC first attempted to relay request: _____	c. TIME actual transmission began _____	
d. TIME FSCC confirmed good copy to receiving agency: _____		
e. Call Sign of agency to whom request was relayed: _____		

[9] Was there a delay between 8a and 8b ? NO YES. If YES, duration and reason _____
Was there a delay between 8b and 8c ? NO YES. If YES, duration and reason _____
Was there a delay between 8c and 8d ? NO YES. If YES, duration and reason _____

[10] Was Fire Support Coordination required for this request? NO YES. If YES, with whom was coordination effected ? ARTILLERY, NAVAL GUNFIRE, AIR. (circle those applicable)	
[11] Were restrictive measures required or in effect relating to this request? NO YES. If YES, check the type listed below:	
[] Check Fire. Time this was effective: From: _____ to: _____	
[] Restrictive Air Plan. Time this was effective: From: _____ to: _____	
[] Restrictive Fire Plan. Time this was effective: From: _____ to: _____	

[12] TIME Fire Support Coordinator APPROVED DISAPPROVED Request: _____
(circle one)

[13] Was there a delay due to fire support coordination ? NO YES. If YES, duration and reason: _____

[14] If request was disapproved, list the names/call signs of the agencies notified and the time this was acknowledged:	
CALL SIGN	TIME ACKNOWLEDGED
_____	_____
_____	_____
_____	_____
[15] If restrictive measures were effected, list names/call signs of the agencies and the time this was acknowledged:	
CALL SIGN	TIME ACKNOWLEDGED
_____	_____
_____	_____
_____	_____

[16] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK: _____ SSN: _____

DATA COLLECTION FORM # 3
DIRECT AIR SUPPORT CENTER (DASC)
NAVY/MARINE CORPS CAS SYSTEM

Date: _____

[1] DASC Call Sign: _____ [2] Location: _____ [3] Unit/FAC Request Number _____
[4] Unit/FAC call sign _____ [5] COMM Net TAR received on: _____
(Net name and frequency band)
[6] TIME FAC confirmed good copy of TAR to DASC: _____ [7] TIME FSCC approved/disapproved TAR _____
[8] Was there a delay between 6 and 7 ? NO YES. If YES, duration and reason _____

[9] a. A/C available to DASC for assignment: GND ALERT, GND ALERT FORWARD, AIR ALERT, DIVERT, NONE.
(circle those applicable. If none are available skip to # 12)

b. Alert Status of ground alert aircraft _____ minutes.

[10] IF AIRCRAFT ARE AVAILABLE: a. A/C selected: GND ALERT, GND ALERT FORWARD, AIR ALERT, DIVERT.
b. TIME this selection made: _____ c. DASC passed order to execute mission to _____
(Call Sign)
d. TIME DASC first attempted to transmit this order: _____ e. Actual transmission began _____
(Time)
f. TIME receiving element acknowledged this order: _____

[11] a. Were there delays between 7 and 10b ? NO YES. If YES, Duration and reason: _____
b. Were there delays between 10b and 10d ? NO YES. If YES, Duration and reason: _____
c. Were there delays between 10d and 10e ? NO YES. If YES, Duration and reason: _____
d. Were there delays between 10e and 10f ? NO YES. If YES, Duration and reason: _____

[12] IF AIRCRAFT ARE NOT AVAILABLE: a. To Whom did DASC pass aircraft request ? _____
(call sign of agency)
b. TIME DASC first attempted to transmit request _____ c. Actual transmission began _____
(Time)
d. Receiving agency acknowledged receipt of request at _____ e. Request was approved / disapproved
(time)
at: _____
(Time DASC acknowledged)

[13] a. Were there delays between 7 and 12b ? NO YES. If YES, Duration and reason: _____
b. Were there delays between 12b and 12c ? NO YES. If YES, Duration and reason: _____
c. Were there delays between 12c and 12d ? NO YES. If YES, Duration and reason: _____
d. Were there delays between 12d and 12e ? NO YES. If YES, Duration and reason: _____

[14] AIRCRAFT INFORMATION. a. Mission/Event Number assigned _____ b. Call Sign _____
c. Number and Type A/C _____ d. Ordnance: ACTUAL SIMULATED _____

[15] TIME Unit/FAC acknowledged mission approval: _____

[16] TIME communications established between DASC and A/C at _____ on _____
(Time) (Name of COMM Net)

[17] TIME aircraft acknowledged order to report to terminal control agency: _____

[18] Terminal control agency was: FAC, ASRT, FAC(A), TAC(A), RABFAC, FLIGHT LEADER.

[19] What was the duration of the delay between 16 and 17 ? _____

[20] Did A/C RIO with DASC after completing mission? NO YES. If YES, DASC directed A/C to: RETURN TO BASE;
(circle one)
ASSUME AIR ALERT; CONDUCT NEW MISSION. If conduct a new mission, call sign of next agency: _____

[21] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ Rank: _____ SSN: _____

DATA COLLECTION FORM # 4
TACTICAL AIR COMMAND CENTER (TACC)
TACTICAL AIR DIRECTION CENTER (TADC)
NAVY/MARINE CORPS CAS SYSTEM

DATE: _____

[1] TACC / TADC Call Sign: _____ [2] Location: _____
(Coordinates)

[3] Request received from: _____ [4] Request received on: _____
(Call Sign) (Comm Net and Frequency Band)

[5] TIME requesting unit confirmed good copy of request to TACC/TADC; _____

[6] Aircraft available to TACC/TADC for assignment: GND ALERT; GND ALERT FORWARD; AIR ALERT; DIVERT; NONE.
(Circle those applicable)

[a] What was the ground alert status ? _____ minutes.

[b] If NONE are available, skip to question # 11.

[7] Aircraft selected: GND ALERT; GND ALERT FORWARD; AIR ALERT; DIVERT. [a] TIME selection made _____
(Circle One)

[b] A/C Call Sign _____ [c] Number and Type aircraft _____

[d] Ordnance: ACTUAL SIMULATED _____ [e] MISSION / EVENT NUMBER _____

[8] Was there a delay between question 5 and 7a ? NO YES. If YES, duration and reason _____

[9] TACC/TADC passed the order to execute the mission to _____ on the _____
(Call Sign of Agency) (Comm Net Name)

[a] TACC/TADC first attempted to transmit order at _____ [b] Actual transmission of the
(Time)

order began at _____ [c] This order was acknowledged at _____
(Time) (Time)

[10] [a] Was there a delay between 7a and 9a ? NO YES. If YES, duration and reason _____

[b] Was there a delay between 9a and 9b ? NO YES. If YES, duration and reason _____

[c] Was there a delay between 9b and 9c ? NO YES. If YES, duration and reason _____

[11] TIME Requesting Unit acknowledged APPROVAL / DISAPPROVAL of request _____
(Circle One)

[12] Was the A/C required to RIO IN with TACC/TADC ? NO YES. If YES, TIME two-way radio communications was
established: _____ ON what radio net: _____

[13] [a] At what TIME did the A/C acknowledge order to report to next control agency ? _____

[b] Call Sign of the next control agency: _____

[14] If A/C were required to RIO, what was the time delay between questions 13 and 14 ? _____ min.

[15] Was the A/C required to RIO OUT with TACC/TADC ? NO YES. If YES, the A/C were directed to:

RETURN TO BASE; ASSUME AIR ALERT; CONDUCT A NEW MISSION. If CONDUCT A NEW MISSION, what was the call sign
(Circle One)
of the next control agency ? _____

[16] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ Rank: _____ SSN: _____

DATA COLLECTION FORM # 5
LAUNCH LOCATIONS
NAVY/MARINE CORPS CAS SYSTEM

DATE: _____

[1] Launch Call Sign: _____ [2] Location _____ [3] Weather: IFR VFR
(Coordinates) (circle one)

[4] Launch Order Received from: _____ [5] Launch Order Acknowledged at _____
(Call Sign of Agency) (Time)

[6] Launch Order Received by RADIO PHONE on the _____ net. FREQUENCY BAND: HF VHF UHF
(circle one) (net name) (circle one)

[7] AIRCRAFT INFORMATION: [a] Call Sign _____ [b] No and Type A/C _____
[c] MISSION/EVENT NUMBER _____ [d] Ordnance: ACTUAL SIMULATED _____

[8] TIME Aircraft acknowledged launch order _____.

[9] Launch Order passed to aircraft by: RADIO PHONE OTHER _____
(Circle one) (Specify)

[10] Was there a delay between question 5 and 8 ? NO YES. If Yes, duration and reason _____

[11] TIME aircraft made take-off _____ [12] Alert Status of Aircraft: _____ minutes
(Wheels up on first aircraft)

[13] What was the time delay between question 8 and 11 ? _____ minutes. If delay longer than the time
listed in question 12, explain reason for excess time: _____

[14] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK: _____ SSN: _____

DATA COLLECTION FORM # 6
TACTICAL AIR OPERATIONS CENTER (TAOC)
NAVY/MARINE CORPS CAS SYSTEM

Date: _____

[1] TAOC Call Sign: _____ [2] Location: _____
(Coordinates)

[3] If TAOC is to relay a CAS mission order to an AIR ALERT or DIVERT aircraft: [a] Call Sign of agency directing TAOC to pass order: _____. [b] TIME directing agency confirmed good copy of CAS mission order to TAOC: _____. [c] Comm Net this order received on: _____
(name of net)
[d] TIME TAOC first attempted to transmit order: _____. [e] TIME actual transmission of order began: _____. [f] TIME aircraft acknowledged this order: _____.
[g] TIME A/C acknowledged order to report to next control agency: _____. [h] Call Sign of next control agency: _____.

[4] [a] Was there a delay between 3b and 3d ? NO YES. If YES, duration and reason: _____
[b] Was there a delay between 3d and 3e ? NO YES. If YES, duration and reason: _____
[c] Was there a delay between 3e and 3f ? NO YES. If YES, duration and reason: _____
[d] Was there a delay between 3f and 3g ? NO YES. If YES, duration and reason: _____

[5] If TAOC is to provide flight following and/or navigational assistance to aircraft: [a] TIME two-way comm established between A/C and TAOC: _____. [b] Comm Net comm established on: _____
(name of net)
[c] TIME aircraft acknowledged order to report to next control agency: _____. [d] Call Sign of next control agency: _____.

[6] AIRCRAFT INFORMATION: [a] Call Sign: _____ [b] No and Type A/C: _____
[c] MISSION/EVENT NUMBER: _____ [d] Ordnance: ACTUAL SIMULATED _____

[7] Was a fire support coordination plan in effect affecting this CAS mission ? NO YES. IF YES;
[a] Type Plan: RESTRICTIVE FIRE PLAN; RESTRICTIVE AIR PLAN; BOTH. [b] Was TAOC required to vector or
(Circle One)
detour CAS aircraft around this plan ? NO YES. If YES, approximately how much additional time did this detour take ? _____ minutes.

[8] Was coordination required with this CAS mission and a friendly fighter mission ? NO YES. If YES, did this coordination delay the CAS aircraft enroute to the Target ? NO YES. If yes, duration of delay _____ min.
At What Time was the CAS aircraft cleared to continue enroute to the target? _____.

[9] Was coordination required with this CAS mission and a friendly SAM mission? NO YES. If YES, did this coordination delay the CAS aircraft enroute to the target ? NO YES. If YES, duration of delay _____ min.
At What Time was the CAS aircraft cleared to continue enroute to the target ? _____.

[10] Was the CAS A/C required to RIO with TAOC after the mission? NO YES. If YES, the aircraft were directed to: RETURN TO BASE; ASSUME AIR ALERT; CONDUCT NEW MISSION. If conduct a new mission, what was the Call Sign of the next control agency ? _____.

[11] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK: _____ SSN: _____

DATA COLLECTION FORM # 7
AIR SUPPORT RADAR TEAM (ASRT)
NAVY/MARINE CORPS CAS SYSTEM

DATE: _____

- [1] ASRT Call Sign: _____ [2] ASRT Location: _____
(Coordinates)
- [3] Call Sign of agency assigning mission to ASRT: _____ [4] TIME sending agency confirms a "good copy" of mission to ASRT: _____
- [5] Target Location: _____ [6] Target Weather: DAY NIGHT IFR VFR
(Circle those applicable)
- [7] AIRCRAFT INFORMATION: [a] Call Sign _____ [b] No and Type A/C _____
[c] MISSION/EVENT NUMBER _____ [d] Ordnance _____ ACTUAL SIMULATED
(amount and type) (circle one)
- [8] Was a radar handoff made to ASRT ? NO YES. If YES, Call Sign of agency making handoff _____
TIME radar handoff accomplished: _____
- [9] [a] TIME two-way radio communications established between ASRT and Aircraft: _____
[b] TIME of radar acquisition by ASRT: _____ [c] TIME of radar lock by ASRT: _____
[d] Distance from A/C to Target at radar Lock: _____ meters.
- [10] Was there a delay between question 8 and 9a ? NO YES. If YES, duration and reason _____
Was there a delay between question 9a and 9b ? NO YES. If YES, duration and reason _____
Was there a delay between question 9b and 9c ? NO YES. If YES, duration and reason _____
- [11] Was a radar beacon used ? NO YES. [12] Method of control: AUTOMATIC MANUAL
(circle one)
- [13] [a] Time Aircraft is 20,000 meters from target on attack course: _____
[b] Time Aircraft acknowledges clearance ("ARMSTRONG") call: _____
[c] Time Aircraft verifies first ordnance released: _____
[d] Time Aircraft verifies last ordnance released: _____
[e] Total number of runs made on target: _____
- [14] Were there delays between 13a and 13c ? NO YES. If YES, duration and reason _____
- [15] TIME aircraft acknowledges order to report to next control agency: _____ Call Sign of the next control agency: _____
- [16] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK: _____ SSN _____

DATA COLLECTION FORM # 8
AIRBORNE CONTROLLER DEBRIEF
NAVY/MARINE CORPS CAS SYSTEM

Date _____

[1] TAC(A)/FAC(A) Call Sign _____ [2] Unit Requesting CAS _____
(Call Sign)

[3] Location of Requesting Unit _____ [4] Mission of Requesting Unit _____

[5] Was TAC(A)/FAC(A) requested to initiate the TAR ? NO YES. If YES, TIME requesting unit confirmed a
"good copy" of request to TAC(A)/FAC(A). _____.

[6] [a] TIME controller first attempted to transmit TAR: _____ [b] TIME actual transmission of
TAR began: _____ [c] Agency to whom TAR was transmitted: _____
(Name or Call Sign)

[d] TIME controller confirmed "good copy" of TAR to receiving agency: _____.

[e] Comm Net used for TAR transmission: _____ Frequency Band: VHF UHF
(name of net)

[7] TAR was APPROVED DISAPPROVED at _____ by _____
(Time controller acknowledged) (Call Sign of Agency)

[8] [a] Was there a delay between question 5 and 6a ? NO YES. If YES, duration and reason _____

[b] Was there a delay between question 6a and 6b ? NO YES. If YES, duration and reason _____

[c] Was there a delay between question 6b and 6d ? NO YES. If YES, duration and reason _____

[d] Was there a delay between question 6d and 7 ? NO YES. If YES, duration and reason: _____

[9] TARGET INFORMATION: [a] Description: _____ [b] Location: _____
(Coordinates)

[c] Target Area Weather: Ceiling _____ Visibility _____ IFR VFR
(Circle One)

[10] AIRCRAFT INFORMATION: [a] Call Sign _____ [b] No and Type A/C _____

[c] MISSION/EVENT NUMBER: _____ [d] Ordnance: ACTUAL SIMULATED

[11] TIME two-way communications established between aircraft and TAC(A)/FAC(A): _____

[a] Comm Net communications established on: _____ Frequency Band: VHF UHF
(Net Name)

[12] TIME controller first sighted aircraft _____.

[13] Was the target marked ? NO YES. If YES, at what TIME was the target marked: _____

How was the target marked ? _____.

[14] TIME aircraft confirms mark / reference point / target in sight: _____ [a] TIME aircraft
acknowledged "cleared hot" clearance: _____ [b] TIME first ordnance released: _____

[c] TIME last ordnance released: _____ [d] Total runs (all A/C) on target: _____

[15] [a] Were there delays between question 12 and 13 ? NO YES. If YES, reason and duration _____

[b] Were there delays between question 13 and 14 ? NO YES. If YES, reason and duration _____

[c] Were there delays between question 14 and 14a? NO YES. If YES, reason and duration _____

[d] Were there delays between question 14a and 14b? NO YES. If YES, reason and duration _____

[16] TIME aircraft acknowledged clearance to report to next control agency: _____ Call Sign of
the next control agency: _____.

[17] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK: _____ SSN: _____

DATA COLLECTION FORM # 9
PILOT/FLIGHT LEADER DEBRIEF
NAVY/MARINE CORPS CAS SYSTEM

Date _____

[1] Aircraft Call Sign _____ [2] No and Type A/C _____ [3] MODEX No _____
(tail #)

[4] MISSION/EVENT NUMBER: _____ [5] Launch Location: _____

[6] Ordnance: ACTUAL SIMULATED _____

[7] Status at the time of mission assignment: PREPLANNED; AIR ALERT; GND ALERT; DIVERT; ASSIGNED MISSION
(C I R C L E O N E)
IMMEDIATELY AFTER COMPLETION OF ANOTHER.

[8] Mission Order received from _____ at _____
(Call Sign of Agency assigning mission) (Time aircraft acknowledged order)

[9] Take-Off TIME _____ [10] Was there delays prior to take-off ? NO YES. If
(First Aircraft wheels up)
YES, reason and duration of the delay: _____

[10] Call Sign of the agency aircraft directed to contact after take off: _____

[11] What were the weather conditions: [a] At Launch location: VFR IFR [b] ENROUTE to target: VFR IFR

[12] Type Control in the target area was: FAC; TAC(A); FAC(A); FLT LEADER; RABFAC; ASRT.
(C i r c l e O n e)

[13] IF CONTROL WAS FAC, FAC(A), TAC(A), FLT LEADER: [a] Any problems in locating or identifying the target?
NO YES. If YES, explain problems _____

[b] Was the target marked ? NO YES. If YES, how was it marked: _____

[14] IF CONTROL WAS RABFAC: [a] Any problems in locating or identifying the beacon ? NO YES. If YES, explain
the problem: _____

[15] IF CONTROL WAS ASRT: [a] Was a radar beacon used ? NO YES. If YES, were there any problems associated
with the beacon ? No YES. If YES, explain problems _____

[b] Were there any problems with radar acquisition/lock by ASRT ? NO YES. If YES, explain problems: _____

[16] TIME first ordnance released: _____ [a] TIME last ordnance released: _____

[b] Was all ordnance expended ? NO YES. If NO, what ordnance remained: _____

[17] AFTER STRIKE, flight was directed to: RETURN TO BASE; ASSUME AIR ALERT; FLY ANOTHER MISSION.
(C i r c l e O n e)

[a] This order was given by: _____
(call sign of agency sending order)

[b] IF RTB, TIME and LOCATION of landing: _____

[18] REMARKS: (Use reverse side of form if necessary)

DATA COLLECTOR: _____ RANK: _____ SSN: _____

DATA COLLECTION FORM #10
Supporting Arms Coordination Center (SACC)
Navy/Marine Corps CAS System

1. (TAR) SACC Call Sign: _____ Location: _____ Date: _____
2. (TAR) Tactical Air Request Number: _____ FAC Request No. (If Different) _____
3. (TAR) Request Monitored: (Responsibility for Supporting Arms Coordination is Ashore)
- a. Time Request Acknowledged: _____
- b. Transmission from (Call Sign): _____
- c. Transmission to (Call Sign): _____
4. (TAR) Request Received: (Responsibility for Supporting Arms Coordination is Afloat)
- a. Request Transmitted by (Call Sign): _____
- b. Time Request Acknowledged (After Readback): _____
5. (TAR) Communications Means Utilized to MONITOR/RECEIVE Request:
- a. Frequency Band (Circle One): HF VHF/FM UHF
- b. Type Net: TAR OTHER (Specify) _____
- c. Communications Problem Experienced (if any) _____
6. (TAR) Request DISAPPROVED by: BN REGT/MAB DIV/MAF TIME: _____
7. (ASC) APPROVAL/DISAPPROVAL (Circle One) by Supporting Arms Coordinator:
- a. Time of APPROVAL/DISAPPROVAL: _____
- b. Reason for DISAPPROVAL: _____
- c. Delays between 4b and 7a: YES NO
- d. Reason for Delay: _____
8. (TAR/ASC) When Mission APPROVED/DISAPPROVED, List Name or Call Sign of Agencies Notified and Time Message Acknowledged by last Implementing Agency:
- | AGENCY | TIME OF ACKNOWLEDGMENT | AGENCY | TIME OF ACKNOWLEDGMENT |
|--------|------------------------|--------|------------------------|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
9. (ASC) Coordination Measures Effected (Indicated Measure):
- a. Restrictive Fire Plan in Effect: YES NO
- b. Restrictive Air Plan in Effect: YES NO
- c. Check Fire Ordered: YES NO
10. (ASC) If a Coordination Measure Effective:
- a. Indicate time of acknowledgment by last implementing unit/agency: _____
- b. Delays experienced in notification of unit/agencies (circle one): YES NO
- c. Reason for Delay: _____
11. (ASC) Circle all available aircraft for mission:
- ABN ALERT DECK ALERT GND ALERT GND ALERT FORWARD DIVERT NONE
12. (ASC) Circle one aircraft selected by ASC:
- a. ABN ALERT DECK ALERT GND ALERT GND ALERT FORWARD DIVERT
- b. Aircraft Event/Mission Number Assigned to the Mission: _____
- c. Time of Selection: _____
- d. Number/Type Aircraft: _____
13. (TAR/ASC) TAR CANCELLED BY: CO. BN REGT/MAB DIV/MAF
- a. Time CANCELLATION Acknowledged: _____
- b. CANCELLATION transmitted by (call sign): _____
14. Remarks (Use Reverse Side).
15. Name of TAR Data Collector: _____
16. Name of ASC Data Collector: _____

DATA COLLECTION FORM #11
TACTICAL AIR CONTROL CENTER (TACC)
Navy/Marine Corps CAS System

1. TACC Data Collection Position: (circle one) TAC TATC TAD 1 TAD 2
2. TACC Location: _____ Date: _____
3. (TAD) Tactical Air Request Number: _____
4. Aircraft Event Selected to Execute Mission:
 - a. Source: (circle one) ABN ALERT DIVERT DECK ALERT GND ALERT GND ALERT FORWARD
 - b. Aircraft Event/Mission Number Assigned to Mission: _____
5. (TAC) Agency to which TACC passed order to launch GROUND/DECK ALERT (call sign) _____
 - a. Time TACC First Attempts to Transmit Order: _____ b. Time this Order Acknowledged: _____
6. (TAC) Delay between 5a and 5b? YES NO Reason: _____

7. (TATC/TAD) Inflight directions submitted to flight leader: (circle one)	
MISSION EXECUTION ORDER	EN ROUTE INSTRUCTION ONLY
a. Time TACC Established Communications with Flight Leader: _____	
b. Time TACC first attempted to transmit Mission Execution Order: _____	
c. Time Mission Execution Order Acknowledged by Flight Leader: _____	
d. Delay between 7b and 7c: YES NO Reason: _____	
e. Net on which Communications Established: TATC _____ TAD _____ OTHER _____	

8. (TATC/TAD) En Route Flight Conditions at Altitude: (circle one) VFR IFR

9. (TATC/TAD) En Route Delays Caused by Alternate Routing or Holding of Aircraft:	
a. Specific Which: (circle one)	ALTERNATE ROUTING HOLDING
b. Reason for Alternate Routing: _____	
c. Reason for Holding: _____	

10. (TATC/TAD) Time Aircraft Acknowledged Instructions to Report to Next En Route Control Agency/TACC Controller?
 - a. Time Aircraft Acknowledged: _____
 - b. Next Controlling Agency/TACC Controller (circle/indicate)
TAD _____ OTHER (call sign) _____
 - c. Comm Net Assigned: TAD _____ OTHER _____
11. (TATC/TAD) En Route Aircraft Divert to Another Mission:
 - a. Divert Ordered by: _____ New TAR Number: _____
 - b. Time Order Acknowledged by Flight Leader: * _____

12. (TATC/TAD) Mission ABORT/CANCELLATION:	
a. Specify Which: (circle one) ARORT	TAR CANX
b. Mission ABORT/TAR CANCELLATION ordered by: (circle) SACC Aircraft _____ Other (call sign) _____	
c. Time MISSION ABORT Acknowledged by TACC: _____ By: Flight Leader: _____	
d. Time TAR CANCELLATION Acknowledged by Flight Leader: _____	
e. Reason for ABORT/CANCELLATION: _____	
f. Subsequent Aircraft Status: (circle one) RTB AIR ALERT	

13. (TATC/TAD) Time Aircraft Acknowledged Instructions to Report to Terminal Control Agency: _____
 - a. Terminal Control Agency: (circle one) FAC(G) FAC(A) ASRT TAC(A)
 - b. Terminal Control Agency Call Sign: _____ c. Communications Net Assigned: TAD _____

14. (TATC/TAD) Time Flight Leader Checked in with TACC after Mission: _____	
15. (TATC/TAD) TACC Directed Flight Leader to: <ol style="list-style-type: none"> a. Conduct another Mission? YES NO New TAR Number: _____ Time Order Acknowledged by Flight Leader* _____ b. Assume Airborne Alert? YES NO Time Order Acknowledged by Flight Leader _____ c. Return to CVA/Base? YES NO Time Order Acknowledged by Flight Leader _____ 	

16. Remarks: Use Reverse Side
17. Name of TAC Data Collector: _____
18. Name of TATC/TAD Data Collector: _____

*NOTE: Record new mission by that aircraft event on another TACC form.

ANNEX D

GUIDANCE FOR IMPLEMENTATION OF CAS REQUIRED IN TRAINING EXERCISE SCENARIOS

1. SCENARIO PREPARATION.

a. The scenario content and sequencing and control of exercise events are the significant factors influencing the accomplishment of the CAS Validation Objectives. The scenario must be planned and written so that selected situations present themselves to the players, who in turn react providing the information to support the objectives, in a realistic sequence. This allows a degree of control in a free play exercise. The degree of control is dependent on the players interpreting the scenario situations. For a complex interaction a few missed key situations in the development may negate the desired reaction on which one is attempting to collect data. Control of situation development may be desirable when the reactions are deviating significantly from the scenario design.

b. The CAS Validation Program is "piggybacked" on scheduled training exercises. Included in these will be the command and control networks to support CAS (Annex E). In a dual objective environment, i.e., where both joint training and the CAS Validation Program Objectives are to be considered, it is essential that each organization identify requirements during scenario development. The type and sequence of situations must be selected to provide maximum information on and about the CAS Validation Objectives (Annex A) while creating no significant impact on the training objectives. In many cases the situations to support the CAS Validation Objectives and the training objectives will be one and the same.

c. The key to successful implementation of the CAS Validation Program is early, continuous, face-to-face liaison and coordination between the Joint CAS Validation Headquarters, in particular the operations analysis team, and the planning group convened to plan and write the scenario for each joint training exercise selected for the CAS Validation Program. This is the best way of integrating the CAS Validation Objectives with the training objectives. Through the medium of close contact at the onset and during the preparation of the scenario, exercise planners and scenario writers will be made aware of the CAS Validation Objectives in time to accommodate the insertions without significant impact on primary training objectives. A shopping list of desired exercise conditions for data collection on the CAS Validation Objectives is required to insure that sufficient information is available to maximize answering the CAS Validation Objectives. A management control technique will be presented in a subsequent paragraph which identifies cumulative progress, both during a specific exercise and for all previous exercises utilized in meeting CAS Validation Objectives. The documentation of this information is essential for achieving the CAS Validation Objectives.

2. CONTROLLED AND FREE PLAY CAS CONDITIONS.

a. The complexity of a command and control system and the large number of variables affecting its performance resulted in a decision to limit the number of conditions which would be specifically documented. Only a limited number of these documented variables can be used to influence the scenario development without significant impact on the training objectives. However, data obtained on the uncontrolled conditions listed in paragraph 2.a.(4) will be collected and documented, and analyzed if a sufficient number of samples are recorded. The controlled exercise conditions are:

(1) Base Case

- (a) Daylight conditions.
- (b) Good weather/visibility.

- (c) No damage to CAS command and control elements.
- (d) No secure voice.
- (e) Standard equipment .
- (f) Limited air threat.
- (g) Limited air defense threat.
- (h) Adequate intelligence.
- (i) Target poor environment.
- (j) No ECM threat.

(2) Deviations From Base Case:

- (a) Night conditions.
- (b) Substantial enemy air threat.
- (c) Substantial enemy air defense threat.
- (d) Target rich environment.
- (e) ECM threat.
- (f) Damaged CAS command and control elements or agencies.
- (g) Reduced weather/visibility.
- (h) Secure voice.
- (i) New equipment .*

(3) First priority should be implementation of Base Case conditions and second priority given to implementation of deviations from Base Case conditions. The order of priority for implementation of deviations from Base Case conditions is as shown in paragraph 2.a.(2).

(4) Uncontrolled Conditions.

- (a) Aircraft.
 - 1. Number.
 - 2. Type.
- (b) Type of Ordnance Drop.
 - 1. Live.
 - 2. Simulated.
- (c) Ordnance.
 - 1. Assigned.
 - 2. Onboard.
- (d) Alert Posture.

* The new items of equipments to be included in the CAS Exercise Program will be identified at some future date.

1. Ground Alert.
 2. Ground Alert Forward.
 3. Deck Alert.
 4. Air Alert.
 5. Divert.
- (e) Alert Status.
1. 05 minutes.
 2. 15 minutes.
 3. Other.
- (f) Weather.
1. At Launch Site (Ceiling/Vis).
 2. At Altitude.
 3. At Target (Ceiling/Vis).
- (g) Total Number of Aircraft Passes/Missions.
- (h) Target Description.
1. Personnel (Open).
 2. Personnel (Cover).
 3. Wheeled Vehicles.
 4. Armored Vehicles/Tanks.
 5. Hardened Structures.
- (i) Type Terminal Control.
1. FAC(A)/Controller.
 2. FAC(G)/Controller.
 3. RABFAC.
 4. ASRT.
 5. TAC(A).
- (j) Mission of Supported Unit.
1. Offense.
 2. Defense.
 3. Retrograde.
 4. Special Operations.
- (k) Terrain.
1. Open.

2. Cluttered.

(1) Target Mark.

1. Pyrotechnic Smoke.
2. White Phosphorus.
3. Laser.
4. Visual.
5. Panels.
6. Other.

3. DETAILED CAS SCENARIO REQUIREMENTS.

a. The CAS command and control networks in the Validation Program have a number of unique paths an immediate CAS request may transit. Sampling all paths is not possible in the present program. For analysis purposes a limited number of paths have been identified in each network. These are identified by the bold links in Figures D-1 thru D-3 and tabulated in Tables D-1 thru D-4. A further discussion of these paths is contained in Annex E. Data will be collected on all paths, with analysis on those not highlighted if sufficient data exists.

b. In the scenario design, the representative(s) from the CAS Validation Headquarters to the planning group developing the scenario should try to have as many exercise conditions inserted consistent with number of missions required. The following provides a shopping list of exercise conditions for the representative(s) to use in maximizing opportunities to collect data on any one exercise. The conduct of the immediate CAS missions should be in accordance with established techniques and procedures.

(1) For Base Case conditions insure that situations present themselves for at least 70 immediate CAS complete missions for the Army/Air Force network, 60 missions (20 per battalion, brigade and division) for the Army Attack Helicopter network, and 90 missions (30 for control afloat and 60 for control ashore) for the Navy/Marine network with all Base Case conditions met simultaneously.

(2) Insure that the situations create a minimum number of ten, (twenty desired), Base Case complete missions processed through each of the representative paths identified.

(3) Aircraft target attacks and reattacks should be conducted in accordance with the simulated ordnance aboard the aircraft.

(4) Deviations from Base Case conditions should be programmed one at a time. If combinations of deviated conditions occur, the data will be collected and documented and analyzed if sufficient data exists.

(5) Insure that situations present themselves for at least 20 complete immediate CAS missions at night.

(6) Insure that situations present themselves for at least 20 complete immediate CAS missions with simulated battle damage to a single node in the network. Battle damage is assumed to render the node totally inoperable for a specified period. A similar number of missions is required for each node with simulated battle damage.

(Battle damage to two or more nodes simultaneously is not recommended, however, data will be collected and documented and analyzed if sufficient data exists. Only consider battle damage to elements with an alternative element to assume the responsibility for the functions).

TABLE D-1

PRIMARY NETWORK PATHS FOR ANALYSIS
ARMY/AIR FORCE COMMAND AND CONTROL NETWORK
FOR IMMEDIATE CLOSE AIR SUPPORT

<u>PATH NUMBER</u>	<u>PATH SEQUENCE</u>	<u>PATH DESCRIPTION</u>
1	A1-A4-B1-C3-D1/D2-E1	DASC meets battalion requirement with ground alert resources.
2	A1-A4-B2-C5-D1/D2-E1	DASC meets battalion requirement with Air Force alert resources under control of the CRC/CRP.
3	A1-A4-B2-C4-D1/D2-E1	DASC meets battalion requirement with divert resources under control of the CRC/CRP.
4	A1-A4-C5-D1/D2-E1	DASC meets battalion requirement with Air Force alert resources under its control.
5	A1-A4-A5-B1-C3-D1/D2-E1	DASC passes battalion requirement to TACC which tasks ground alert resources.
6	A1-A4-A5-B2-C5-D1/D2-E1	DASC passes battalion requirement to TACC which tasks airborne alert resources under control of the CRC/CRP.
7	A1-A4-A5-B2-C4-D1/D2-E1	DASC passes battalion requirement to TACC which tasks divert resources under control of the CRC/CRP.

NOTES: FROM JSTF CAS STUDY PHASE II, EXECUTIVE SUMMARY, FIGURE 2, PART II AND FIGURE 6, CHAPTER 3, PART VI, VOL. IIP.

1. Any commander may divert assets under the control of a subordinate commander. A decision to commit or request attack helicopters may be initiated at any level from division through company based on the commander's assessment of the tactical situation. It does not necessarily originate at the company level.
2. Any commander may request support from higher headquarters if available assets are not sufficient.

3. The prevailing tactical situation determines which organizations depicted below will have control of attack helicopter assets.
4. Controller may be a company commander, squad leader, platoon leader, P. O., scout helicopter or another attack helicopter.
5. ADDED: Heavy lines depict the representative paths used in JSTF CAS STUDY PHASE II which will be highlighted in the CAS Validation Program. Modes (F1), (F2), and (F3) are added (discussed in Chapter 6, Section 3). Alphanumeric codes are those used in JSTF CAS Study, Phase II.

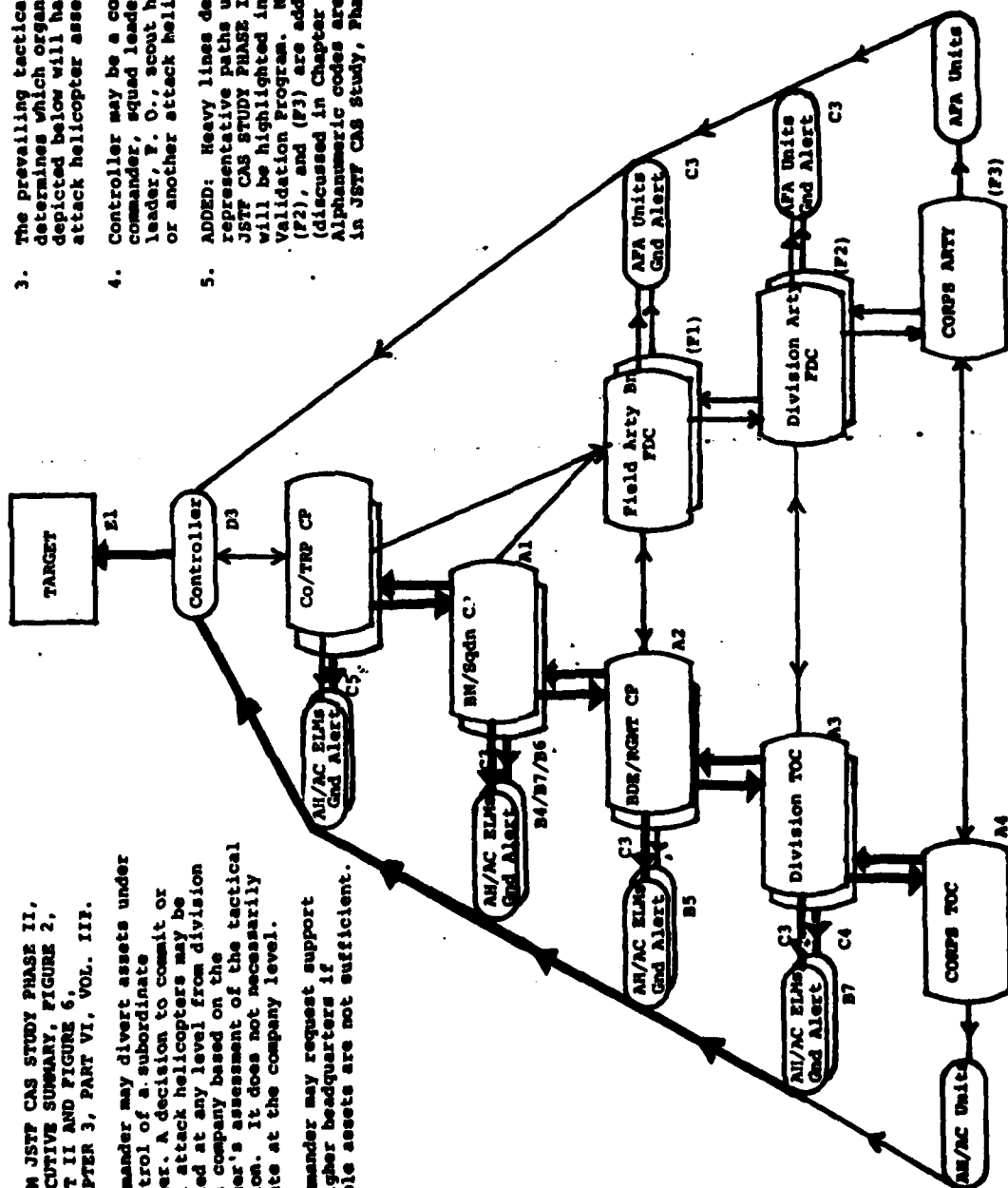
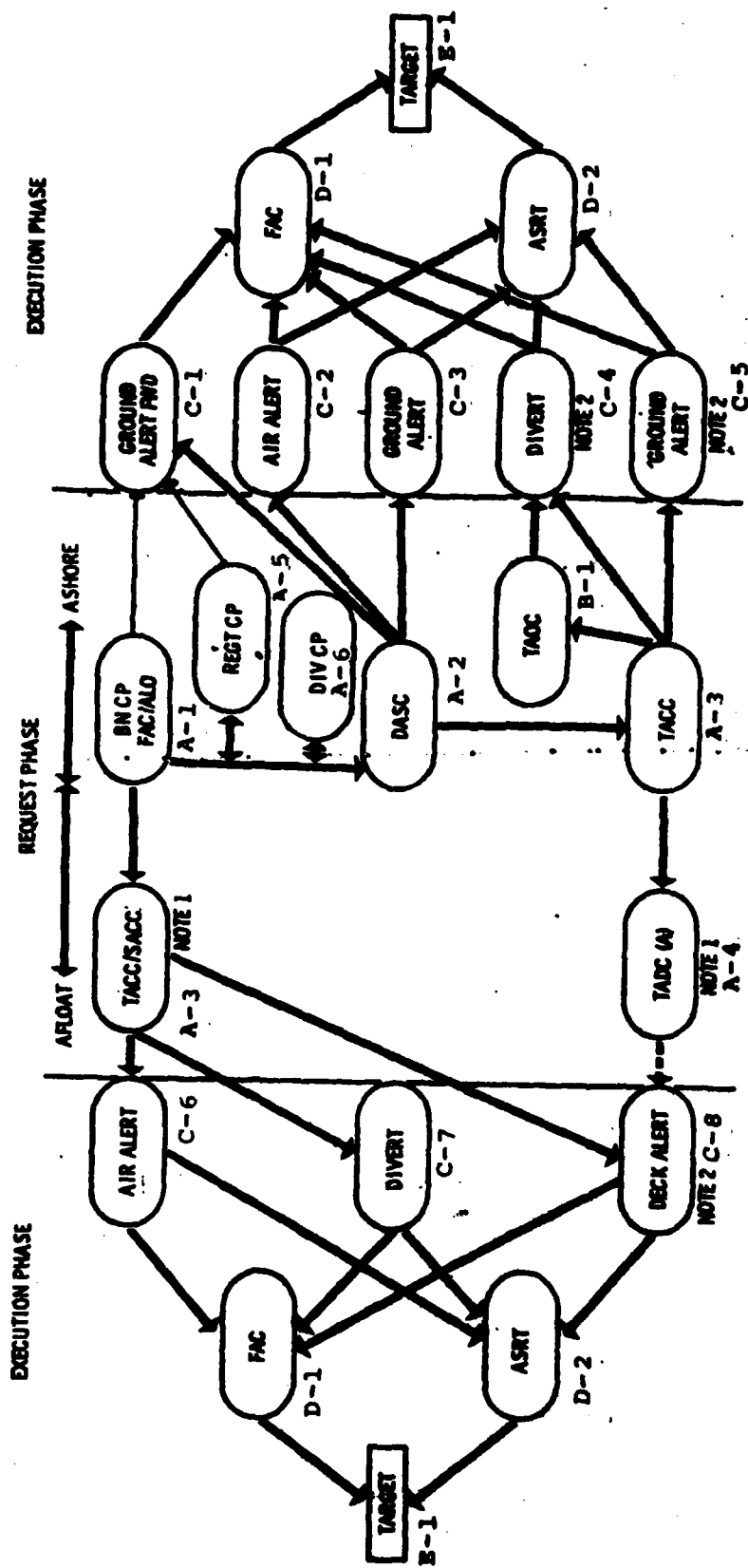


Figure D-2. Army Command and Control Network for Attack Helicopters CAS

TABLE D-2
PRIMARY NETWORK PATHS FOR ANALYSIS
ARMY COMMAND AND CONTROL NETWORK
ATTACK HELICOPTER CLOSE AIR SUPPORT

<u>PATH NUMBER</u>	<u>PATH SEQUENCE</u>	<u>PATH DESCRIPTION</u>
1	A1-C3-D3-E1	BN CP meets requirement with AH under BN control - ground alert.
2	A1-C5-D3-E1	BN CP meets requirement by diverting AH under control of adjacent company.
3	A1-A2-C3-D3-E1	BN CP requests AH from BDE. BDE meets requirement with AH under BDE control-ground alert.
4	A1-A2-B4-C5-D3-E1	BN CP requests AH from BDE. BDE meets requirement by tasking adjacent BN to provide AH. BN meets requirement by diverting AH under control of adjacent company or ground alert.
5	A1-A2-A3-C3-D3-E1	BN CP requests AH from BDE. BDE passes request to Division. Division meets requirement with AH under Division control - ground alert.
6	A1-A2-A3-B5-B6-C5-D3-E1	Bn CP requests AH from BDE. BDE passes request to Division. Division meets requirement by tasking adjacent BDE to provide AH. BDE tasks adjacent BN; BN diverts AH under control of adjacent company or ground alert.
7	A1-A2-A3-A4-B7-C4-D3-E1	BN CP requests AH from BDE, BDE passes request to Division, Division passes request to Corps. Corps tasks adjacent Division. Division meets requirement with AH under Div control - ground alert.



NOTES:

1. TACC IS EITHER AFLOAT OR ASHORE BUT NOT BOTH. WHEN CONTROL MOVES ASHORE, TACC (A) IS ACTIVATED AND SUPPORTS TACC. IN PRACTICE THE SHC NETWORK WILL PHASE GRADUALLY FROM THE AFLOAT CASE SHOWN ON THE LEFT TO THE ASHORE CASE SHOWN ON THE RIGHT.

2. WITH CONTROL ASHORE, AIRCRAFT DIVERTED OR LAUNCHED BY TACC DIRECTION WILL NORMALLY REPORT TO TACC FOR ENROUTE CONTROL AND DASC FOR MISSION BRIEF PRIOR TO CONTACTING THE TERMINAL CONTROLLER.

Figure D-3. Primary Network Paths for Analysis - Navy/Marine Corps Network

TABLE D-3

PRIMARY NETWORK PATHS FOR ANALYSIS

NAVY/MARINE CORPS NETWORK (CONTROL AFLOAT)

<u>PATH NUMBER</u>	<u>PATH SEQUENCE</u>	<u>PATH DESCRIPTION</u>
1	A1-A3-C8	TACC/SACC meets TAR with Deck Alert aircraft
2	A1-A3-C7	TACC/SACC meets TAR with Divert Assets
3	A1-A3-A6	TACC/SACC meets TAR with Air Alert Aircraft

TABLE D-4

PRIMARY NETWORK PATHS FOR ANALYSISNAVY/MARINE CORPS NETWORK (CONTROL ASHORE)

<u>PATH NUMBER</u>	<u>PATH SEQUENCE</u>	<u>PATH DESCRIPTION</u>
1	A1-A2-C1	DASC meets TAR with Ground Alert Forward Aircraft
2	A1-A2-C2	DASC meets TAR with Air Alert Aircraft
3	A1-A2-C3	DASC meets TAR with Ground Alert Aircraft
4	A1-A2-A3-B1-C4	DASC passes TAR to TACC which tasks the TAOC to Divert Aircraft.
5	A1-A2-A3-C5	DASC passes TAR to TACC which meets the request with Ground Alert Aircraft
6	A1-A2-A3-C8	DASC passes TAR to TACC which meets the request with Deck Alert Aircraft

(7) Insure that situations present themselves for at least 20 complete immediate CAS missions using a secure voice net.

(8) Insure that situations present themselves for at least 20 complete immediate CAS missions using each item of new/improved equipment identified by component commands for testing.

(Where possible, interject any one item of new/improved equipment in a given time period. If more than one type is used, data will be collected and documented and analyzed if sufficient data exists).

(9) Insure that situations present themselves for at least 20 complete immediate CAS missions with a significant enemy air threat.

(The level of the threat provides a stimulus to the coordination problems. It is not intended for a survivability/vulnerability analysis. Insure that air-to-air and ground-to-air is played countering this threat, so that air defense coordination will be required).

(10) Insure that situations present themselves for at least 20 complete immediate CAS missions with a significant enemy surface-to-air defense threat.

(Interject a significant number of surface-to-air gun/missile weapons systems in the area where immediate CAS will be requested. The deployment of these weapons systems should be realistic. The purpose is to initiate coordination between the aircraft and terminal controller in a high threat environment.

(11) Insure that situations present themselves for at least 20 complete CAS missions in a target rich environment.

(Generate enough situations to create simultaneous immediate CAS requests stressing the available CAS resources; i.e., terminal control, aircraft availability, DASC, TACC, fire support coordination element, etc.).

(12) Insure that situations present themselves for at least 20 immediate CAS missions in an ECM environment.

(Where possible, include communications jamming, and radar control jamming -- separately and in combinations. The number of missions generated through the situations needs to be at least 20 for each category).

(13) Insure that situations present themselves for immediate CAS missions in a high fire support coordination environment, where CAS missions would be intermixed with surface-to-surface artillery fires.

(Insure that numbers of weapons systems and potential targets are sufficient to create fire support coordination problems).

(14) Insure that situations present themselves for at least 20 complete immediate CAS missions in reduced visibility.

(Target area weather conditions are such that a mission cannot be visually controlled and the target cannot be visually illuminated. If possible, have an alternate scheme to artificially reduce through simulation the visibility when weather conditions remain continuously good).

(15) Insure that situations generated do not focus on one target marking system; i.e., laser, smoke, panels, rockets, etc.

4. EXERCISE SCENARIO CONTROL PLAN. The scenario should be done in close coordination with the sponsoring command. The first step should be to determine the number of assets available and the particular training objective(s) which are programmed. After analyzing the situation determine the appropriate CAS validation insertions. These are a function of the accomplishments in previous exercises, resource availability and impact on the training

mission. An example of an analysis might have resulted in the following control plan:

Day #1

0600-1700 All missions Base Case conditions concentrating on the representative paths identified in Figure D-1 and D-2.

Night #1

1900-2400 Night missions for deviation from Base Case conditions.

Day #2

0600-1200 Communications jamming.

1300-1700 Radar jamming.

Night #2

1900-0300 Same as Night #1.

5. ALLOCATION OF CONTROLLED FACTORS TO EXERCISES.

a. The analysis requirement for minimum and desired number of immediate CAS missions under each of the controlled factors will exceed the established constraints (duration, amount of air capability apportioned to CAS training objectives) for any one exercise. This precludes the ideal situation of gathering a full data base on each exercise. Apportioning a little to each condition in each exercise may result in an unusable data base; i.e., the partial data on one condition gathered from BRAVE CREW may not be from the same statistical set as that gathered from BRAVE SHIELD IX as a result of location, size, purpose, scope and tactical context.

b. For the reasons above, the desired planning procedure is to run all Base Case requirements in each exercise along with one or more deviations from Base Case. Each deviation from Base Case should be satisfied in one exercise. Where more than one deviation is addressed, each deviation should be run independently during different time periods of the exercise. It is recognized that the desired requirement for a Base Case data set, and the accomplishment of the nine deviations from Base Case from each exercise, is not feasible in the selected exercise program. As an alternative a complete Base Case data set for each command and control network for CAS should be completed in at least one exercise. In the remaining exercises the Base Case requirements could be relaxed to allow accomplishment of the various deviations with a minimum of one path of Base Case data. The selection of deviations should be based on the training objectives for the particular exercise under consideration and the priorities established in paragraph 2.a.(2). Once data has been collected on one deviation, emphasis should be placed on excluding this deviation from future exercises, if it will not interfere with training objectives, nor hinder the operation of the Services command and control networks for CAS. This non-duplication will allow the maximum number of conditions to be observed during the total exercise program.

c. A sample allocation of controlled factors might look like Table D-4 for the Army/Air Force command and control network for CAS. A chart of actual accomplishments would be developed as the exercise program develops for each of the command and control networks for CAS.

6. VERIFICATION OF EXERCISE CONDITIONS.

a. Certain aspects of exercise control do affect the CAS validation effort, however, the CAS Validation Headquarters has no desire or intention of assuming any exercise control function. Those areas where exercise control is important to the CAS Validation Program will be made known to exercise planners and scenario writers during the development of the scenario. There is an equally important area where intentions must be made known: the player units. The players need to know the importance of reacting in accordance with their established techniques and procedures and the exercise situation. There is

**PLANNED CONDITIONS FOR CAS VALIDATION
ON
Exercise**

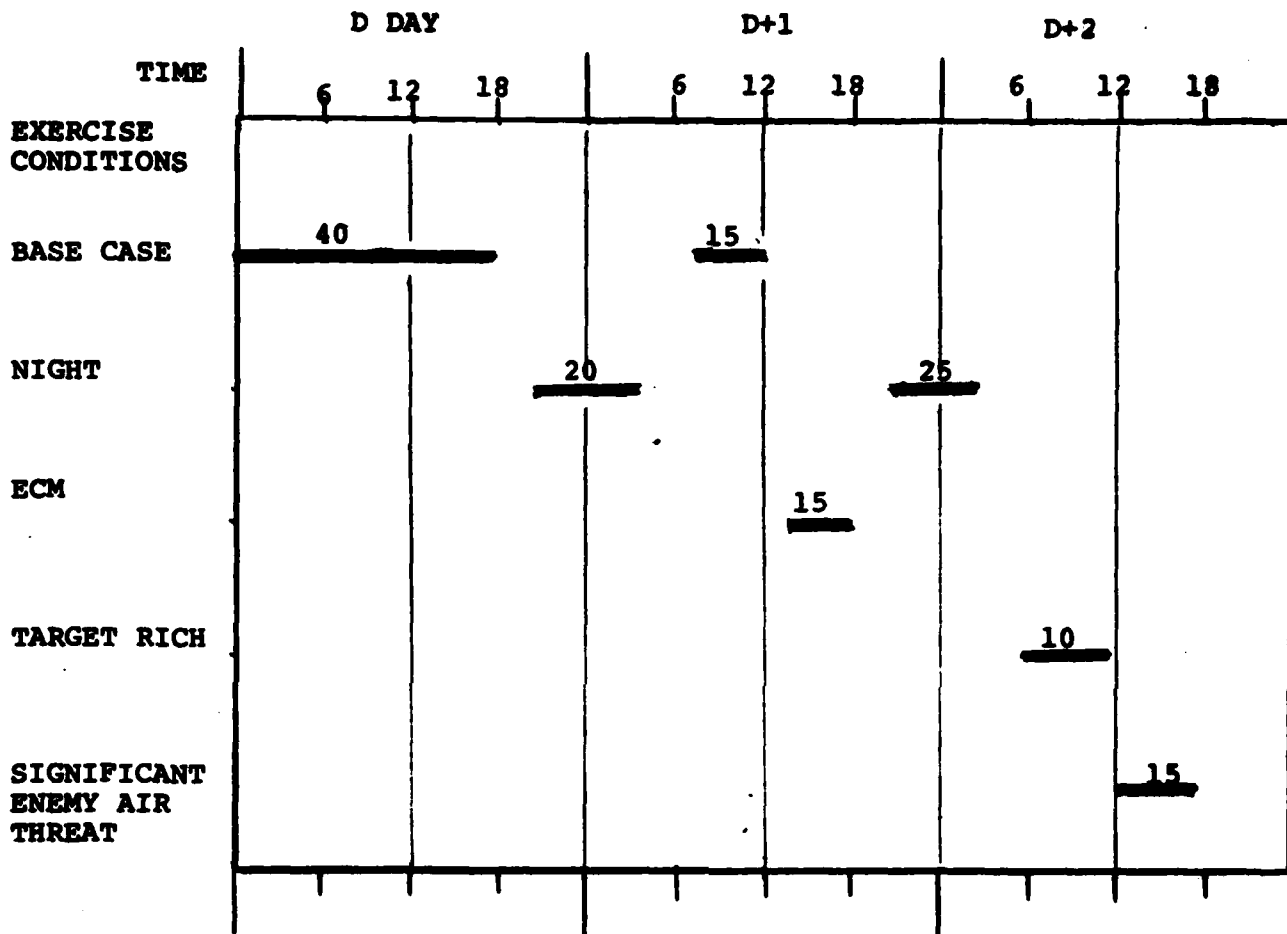


Figure D-4. Sample Bar Graph of Planned CAS Validation Conditions

a tendency to gloss over some areas in exercises, especially when there is no risk of life with the actions taken; e.g., in an exercise in which artillery fire is simulated, appropriate umpires must ensure that all required fire support coordination measures are taken, just as though live rounds were being fired; pilots must be instructed to react to a high threat environment, etc. The information required by the CAS Validation Program must be as close to realism as possible.

b. The time history of each CAS request conducted during an exercise will be constructed using data collected by Joint CAS Validation Headquarters personnel. However, in order to determine completely the circumstances under which each mission was conducted, considerable documentation will be required which can only be supplied by the units participating in the exercise. Examples of such documentation are operations plans and orders, fragmentary orders, Joint Strike Request Form, etc. Early in exercise planning, the Joint CAS Validation Headquarters, in coordination with the player units, must determine what documentation will be available and make arrangements for them to be supplied.

c. Because of the importance of the Joint Strike Request Form, copies must be provided by player units to the CAS Validation Headquarters for all immediate CAS requests. The latest approved forms should be used for all immediate CAS requests.

d. Prior to each exercise the Joint CAS Validation Headquarters will provide general guidance to the player commanders. This guidance will include a brief discussion of the CAS Validation Objectives, exercise conditions desired, the type of exercise data which will be collected, to include any requirements for player forms/logs, etc., any player controlled actions which would assist in improving the exercise data without detracting from realism, and solicit support for the data collectors.

ANNEX E

CAS NETWORK EVENT MODELS

1. GENERAL.

a. The purpose of this chapter is:

(1) To establish descriptive models of the Army/Air Force, the Army Attack Helicopter, and the Navy/Marine Corps Command and Control Networks for Close Air Support.

(2) To identify and define the increments of elapsed times required for analysis of the command and control functions associated with the conduct of immediate CAS missions, and

(3) The development of data form questions which will identify these increments for manual field collection.

b. Each command and control network for CAS provides for integration of close air support with the fire and maneuver of the ground forces. The three networks were analyzed in light of the essential command and control agencies or elements involved in an immediate CAS mission. The command and control elements within the networks were analyzed to identify the critical events associated with the immediate CAS functions performed by each element to include communications, processing, and transit time. In general, critical events are defined as the beginning or ending of a CAS function for which data are required to satisfy one or more CAS Validation Objective(s). Event diagrams were constructed to portray the sequence in which the critical events normally occur during the conduct of an immediate CAS mission. The resulting sequence of events and definitions were used to construct data form questions which are contained in Annex B. Pairs of events are designated to identify increments of elapsed times required for analysis of immediate CAS missions. The uncontrolled variables which may affect elapsed times are identified for data collection.

c. Analysis of the three command and control networks for CAS indicates that the Execution Phases are sufficiently similar to be described by a single sequence of events. Because of major differences among the command and control networks in the Request Phase, it is not possible to describe them with a single sequence of events. Hence, it was necessary to construct a sequence of events for the Request Phase for each command and control network analyzed. The command and control networks for immediate CAS are described in the subsequent paragraphs of this chapter.

d. Analysis of the differences among the networks indicated that it is not realistic to select a common starting point for measurement of elapsed times for the Request Phase. The starting point for measurement of Request Phase elapsed time is unique to each of the three command and control networks for CAS. For the Army/Air Force Network, the start time is when the battalion TACP acknowledges a request for immediate CAS. For the Army Attack Helicopter Network, the start time is when a company/troop CP acknowledges a request or identifies a requirement for immediate CAS. For the Navy/Marine Corps Network, the start time for the Request Phase is the time a Forward Air Controller (FAC) initiates a Tactical Air Request (TAR).

e. Differences among the systems also necessitated the development of unique sets of data form questions for the elements within each of the command and control networks.

f. The following paragraphs depict the Request Phase of an immediate CAS mission for the three command and control networks for CAS followed by a description of the Execution Phase which is described by a single sequence of events. The last section presents a listing of mission variables.

2. ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR IMMEDIATE CLOSE AIR SUPPORT.

a. General. The Army/Air Force command and control network for immediate close air support (Figure E-1) depicts the control elements in the Air Force Tactical Air Control System (TACS) involved in CAS integrated with the Army Command and Control System.

(1) The Army Command and Control System provides decision making focal points for CAS where the type of fire support is determined, i.e., attack helicopter, fixed wing CAS, or other organic Army resources. This decision may be made at all levels of command. The focal points are indicated by the nodes A1 thru A5.

(2) The Tactical Air Force Commander (TAPC) has the responsibility for conducting air operations to include counter air, air interdiction, close air support, reconnaissance, and airlift. In joint operations the priorities are established by the Joint Force Commander. The TAPC directs tactical operations, enabling him to provide close air support in conjunction with the many other responsibilities, through the TACS.

b. Command and Control Network for Close Air Support.

(1) Close air support is divided into preplanned and immediate missions. A preplanned CAS request is generated from a request for fire support to support an operation. The request for preplanned close air support is passed in the Army command and control net up to corps, with monitoring at subordinate commands. At any level it may be decided that Army organic fire support weapons should be used. Army organic fire support weapons are weapons assigned to the various Army echelons of command, i.e., attack helicopters, artillery, mortars, missiles, etc. The CORPS/DASC is the first level of command where an approval is given for preplanned close air support. An immediate close air support request is passed through the control elements of the TACS. It is this request net which is addressed in this section.

(2) The immediate CAS mission has been subdivided into two phases; the request phase and the execution phase. The Execution Phase was considered common to the three networks in the validation program (see paragraph 5). The Request Phase will be outlined in this section.

(3) An immediate close air support request is generated from a request for immediate fire support. Battalion is the lowest level of command where the decision is made to request immediate fixed wing close air support. An initial decision to request immediate close air support may also be made at brigade, division, and corps. The request for immediate fixed wing close air support is passed to the USAF at the level of command where the request is generated. Figure E-1 depicts the immediate close air support request net.

(4) The request for immediate fixed wing close air support at battalion is passed to the Battalion Tactical Air Control Party (BN CP/TACP) (A1). They in turn pass the request to the Direct Air Support Center (DASC) (A4) at corps. The TACP at division and brigade monitors this request. Division (A3) or brigade (A2) may disapprove the immediate CAS request because of a higher priority CAS requirement, difficulties in fire support coordination, or a decision to support the request with other Army means. If they decide to use immediate fixed wing close air support allocated resources, the request is filled with an air alert/divert by the appropriate TACP (A2 or A3). Allocated resources are specific numbers of USAF aircraft sorties allocated to the DASC (A4) from the TACC (A5) for control who may in turn allocate them to the division or brigade for use during a specific time period for carrying out close air support missions. The TACC owns all aircraft resources. They decentralize tasking of preplanned and immediate close air support to the DASC through the allocation of blocks of aircraft sorties. At the time the request for immediate close air

* Figure E-1 was taken from JSTF CAS Study, Phase II, with additional links to the ASRT from DIV TACP air alert/divert and a ground alert node added to more accurately represent the network.

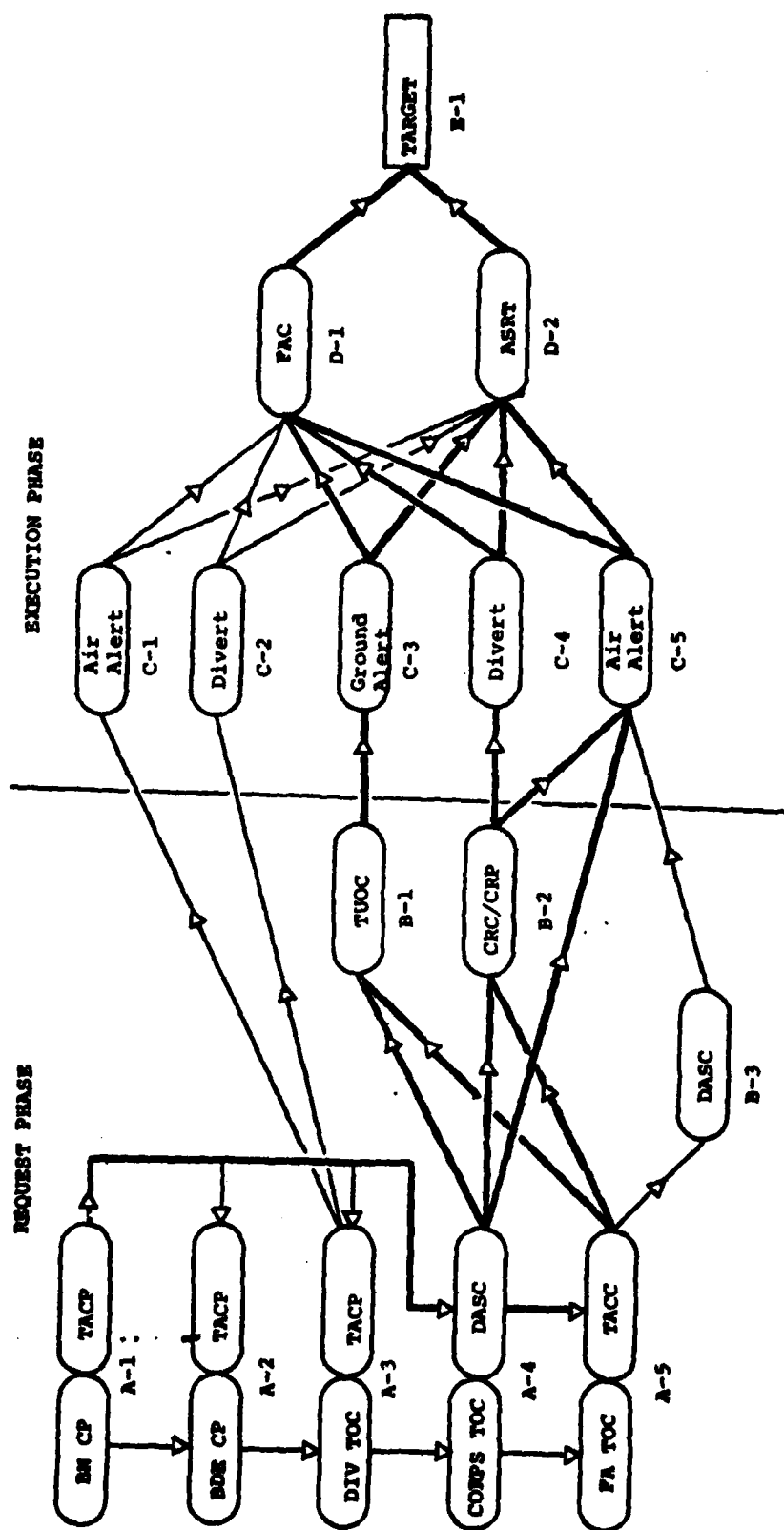


Figure E-1. Army/Air Force Command and Control Network for Close Air Support

support reaches the CORPS TOC/DASC, (A4) a parallel decision takes place. The corps approves the request or disapproves it in lieu of organic resources. At the same time the DASC (A4) is reviewing its current assets to determine the fastest available means to satisfy the request for immediate close air support. The DASC (A4) may fulfill an immediate close air support request once the corps commander or his representative approves the request by five means:

(a) Task allocated ground alert sorties through the Tactical Unit Operations Center (TUOC) (B1).

(b) Task allocated air alert sorties under the control of the Control and Reporting Center (CRC) (B2).

(c) Divert allocated airborne sorties on other missions under the control of the CRC (B2).

(d) Task allocated air alert sorties under the control of the DASC (C5).

(e) Request support from TACC if no other timely resources are available. (A5).

(5) The TACC (A5) may at any time assume control and direct the use of available resources. The TACC (A5) has available ground alert through the TUOC (B1), air alert through the CRC (B2) or divert an ongoing tactical mission through the CRC (B2). Most requests will be initiated at battalion level, however, requests may be initiated at brigade, division or corps.

(6) The network prescribed in the JSTF Close Air Support Study, Phase II, was used as the basis for construction of the sequence of critical events in the request phase of an immediate CAS mission (Figure E-2). Further, the nodes in the Request Phase include the BN CP/TACP (A1), BDE CP/TACP (A2), DIV TOC/TACP (A3), CORPS TOC/TACP (A4), TACC (A5), TUOC (B1), CRC (B2), CRPs, and the FACPs. A request may transit two or more nodes prior to acknowledgement of tasking by the flight leader. Further, current supplemental information from USAFRED was used to insure compatibility with the USAF TACS, in terms of equipment, communications, and procedures, which will be employed in the joint training exercises selected for the validation program. The CAS sequence of critical events diagram is generally composed of two times: the time that elements acknowledge the receipt of a message, and the time of first attempt to transmit responding instructions to the acknowledged message.

(7) There are many paths through the network shown in Figure E-1. Requests may be initiated at all levels from battalion to corps with override capability or redirections in the case of aborts at higher echelons. To obtain sufficient sample sizes for all paths is not possible in exercise programs. Some of the combinations have a very low probability of occurrence. Seven paths were chosen for highlighting in the CAS validation program. These are identified in Figure E-1 with bold connecting links. A tabular description of these paths is identified in Table E-1. These seven paths are those identified in JSTF CAS Study, Phase II, Chapter 3, Part VI, less the path from division to alert/divert resources and from TACC (A5) to an adjacent DASC (B3). The additional DASC (B3) will not be employed in any of the planned exercises. Satisfying a battalion request with division alert/divert resources is not a frequent occurrence. The data collection system and analysis methodology are not restricted to these seven paths. The other remaining paths where sufficient data exists will be analyzed. The primary reason for limiting the number of paths sampled was to reduce the number of immediate CAS missions required.

c. Event Diagram.

(1) The most common start point of the request phase (R-01) starts when the BN CP/TACP acknowledges a close air support request. Brigade and division TACPs monitor (R-20/16) the BN CP/TACP initial request, thus allowing coordination at both levels simultaneously. If either Army echelon disapproves the request, that TACP notifies the CORPS TOC DASC and the BN CP/TACP. When the CORPS TOC/DASC has allocated resources to BDE CP/TACP or DIV TOC/TACP

TABLE E-1

PRIMARY NETWORK PATHS FOR ANALYSIS

ARMY/AIR FORCE COMMAND AND CONTROL NETWORK

FOR IMMEDIATE CLOSE AIR SUPPORT

<u>PATH NUMBER</u>	<u>PATH SEQUENCE</u>	<u>PATH DESCRIPTION</u>
1	A1-A4-B1-C3-D1/D2-E1	DASC meets battalion requirement with ground alert resources.
2	A1-A4-B2-C5-D1/D2-E1	DASC meets battalion requirement with Air Force alert resources under control of the CRC/CRP.
3	A1-A4-B2-C4-D1/D2-E1	DASC meets battalion requirement with divert resources under control of the CRC/CRP.
4	A1-A4-C5-D1/D2-E1	DASC meets battalion requirement with Air Force alert resources under its control.
5	A1-A4-A5-B1-C3-D1/D2-E1	DASC passes battalion requirement to TACC which tasks ground alert resources.
6	A1-A4-A5-B2-C5-D1/D2-E1	DASC passes battalion requirement to TACC which tasks airborne alert resources under control of the CRC/CRP.
7	A1-A4-A5-B2-C4-D1/D2-E1	DASC passes battalion requirement to TACC which tasks divert resources under control of the CRC/CRP.

either level may intercede using their allocated resources, announcing the action to both higher and lower echelons (R-11/14). Brigade or division may decide to use Army organic fire support weapons, again this is announced by the appropriate TACP to both higher and lower echelons (R-19/23). In the case of an aborted aircraft (R-17/21) the BDE CP or DIV TOC may choose to fulfill the original request from Army organic fire support (R-19/23), from other airborne missions (R-11/14), or a request for additional resources from CORPS TOC/DASC (R-11/14). Normally approved requests at CORPS TOC/DASC result in the utilization of allocated ground alert resources via the TUOC (R-06) or air alert/divert resources via the CRC (R-08). A less common use of allocated DASC resources is the direct use of air alert (R-05) when tactical conditions are favorable. If allocated resources are not available, request is made for TACC resources (R-27). The TACC would then use either ground alert or air alert/reserve resources through the TUOC or CRC (R-6/8) or divert an ongoing interdiction or counter air mission through the CRC (R-8). The TACC may at any time assume control and use its resources in place of DASC allocated resources. En route control for all sorties is provided on an "as needed" basis by the CRC, CRPs, and/or FACPs. An initial request may also start at brigade, division, or corps (R-10/13/33). In these cases, that portion of the remaining request phase outlined above will be utilized.

(2) It should be noted that there are many alternate routes of communication in Figure E-1. Alternate communication routes have not been specifically shown in Figure E-2; however, preparation for collection of this information has been made. Principal among these is the Army Command and Control Network which parallels the Air Force BN CP/TACP to the CORPS TOC/TACC. Additionally, cancellations, holds, aborts and delays can occur between and within organizational elements. The information collecting system has been designed to record these actions and the reasons therefor.

(3) As has been indicated in earlier chapters, the control of certain conditions as departures from a selected base case will assure, insofar as possible, that adequate data will be available to measure the difference in distributions of times between certain events as a function of the objectives. The variables as previously defined will be recorded so that their effect on the performance of command and control network may be assessed as sample sizes allow. The data form questions for the applicable command and control elements are designed to collect this information. Annex C, Appendix 1, contains these forms.

d. Event Definitions. The events depicted in Figure E-2 have been designated R-01, to R-34, E-01, E-02, and E-18. Their definitions are contained in Table E-2.

e. Elapsed Times Between Specified Events. Elapsed times have been defined for processing times within a command and control node and communication times from node-to-node. The link times are a summation of the processing times at one node with the communication time to the next node. The Request Phase time is a summation of the link times for a particular mission. This macro-breakdown was selected because of the flexibility of analysis it provides.

(1) The elapsed processing time for each node in the Army/Air Force Command and Control Network for Close Air Support is presented in Table E-3.

(2) The elapsed node-to-node communication time in the Army/Air Force Command and Control Network for Close Air Support is presented in Table E-4.

(3) In the Army/Air Force Command and Control Network for Close Air Support, link times were identified for those links in the JSTF CAS Study, Phase II. To be compatible and provide a base of comparison, the link times as presented in terms of the sequence of event diagram (Figure E-2) are presented in Table E-5.

(4) The overall Request Phase time is dependent on the point of initial request and the type of resource employed. There are several paths a request may take in the network. Figure E-3 depicts the nodal points with the appropriate identification numbers, from Figure E-2, identifying the node-to-node

TABLE E-2

EVENT DEFINITIONS

ARMY/AIR FORCE COMMAND AND CONTROL NETWORKFOR IMMEDIATE CLOSE AIR SUPPORT

<u>EVENT</u>	<u>DESCRIPTION</u>
R-01	Time initial request from BN CP acknowledged by the BN CP/TACP.
R-02	Time first attempt to transmit request from the BN CP/TACP to the CORPS TOC/DASC.
R-03	Time request from the BN CP/TACP acknowledged by the CORPS TOC/DASC.
R-04	Time first attempt to transmit request from the CORPS TOC/DASC to the CRC, tasking air alert/divert resources.
R-05	Time first attempt to transmit request from the CORPS TOC/DASC to the TUOC tasking ground alert resources.
R-06	Time request from the CORPS TOC/DASC acknowledged by the TUOC.
R-07	Time first attempt to transmit request from the TUOC tasking to the ground alert flight leader.
R-08	Time tasking request from CORPS TOC/DASC acknowledged by the CRC.
R-09	Time first attempt to transmit request from the CRC tasking the air alert/divert flight leader.
R-10	Time initial request from the DIV TOC acknowledged by the DIV TOC/TACP.
R-11	Time first attempt to transmit request from the DIV TOC/TACP to the CORPS TOC/DASC or flight leader.
R-12	Time request from DIV TOC/TACP acknowledged by the CORPS TOC/DASC.
R-13	Time initial request from the BDE CP acknowledged by the BDE CP/TACP.
R-14	Time first attempt to transmit request from the BDE CP/TACP to the CORPS TOC/DASC or flight leader.
R-15	Time request from BDE CP/TACP acknowledged by the CORPS TOC/DASC.
R-16	Time DIV TOC/TACP monitors BDE or BN initial request. (Communication complete)
R-17	Time abort notification from flight leader acknowledged by DIV TOC/TACP.
R-18	Time cancellation acknowledged by the DIV TOC/TACP.
R-19	Time first attempt by DIV TOC/TACP to transmit cancellation to CORPS TOC/DASC and initial requesting node.

TABLE E-2 (Concluded)

<u>EVENT</u>	<u>DESCRIPTION</u>
R-20	Time BDE CP/TACP monitors BN initial request. (Communication complete)
R-21	Time abort notification from flight leader acknowledged by BDE CP/TACP.
R-22	Time cancellation acknowledged by the BDE CP/TACP.
R-23	Time first attempt to transmit cancellation to the CORPS TOC/DASC and the initial requesting node.
R-24	Time cancellation acknowledged by the BN CP/TACP.
R-25	Time DIV TOC/TACP acknowledges lower echelon initial request.
R-26	Time BDE CP/TACP acknowledges lower echelon initial request.
R-27	Time request from CORPS TOC/DASC acknowledged by the TACC.
R-28	Time first attempt to transmit request from the TACC to the TUOC tasking ground alert resources, or to the CRC, tasking air alert/divert resources.
R-29	Time first attempt to transmit request for TACC resources from the CORPS TOC/DASC to the TACC.
R-30	Time of acknowledgment of abort notification from flight leader, CRC, CRP, FACP, or ASRT by the CORPS TOC/DASC.
R-31	Time cancellation notice from the DIV TOC/TACP to the CORPS TOC/DASC acknowledged.
R-32	Time cancellation notice from the BDE CP/TACP to the CORPS TOC/DASC acknowledged.
R-33	Time initial request from CORPS TOC acknowledged by the CORPS TOC/DASC.
R-34	Time first attempt to transmit cancellation to BN CP/TACP, BDE CP/TACP or DIV TOG/TACP.
E-01	Time ground alert flight leader acknowledges tasking from TUOC.
E-02	Time air alert/divert flight leader acknowledges tasking from CRC, DIV TOC/TACP, BDE CP/TACP, CORPS TOC/DASC.
E-18	Time flight leader reported that mission has been aborted.

TABLE E-3

ELAPSED PROCESSING TIME

ARMY/AIR FORCE COMMAND AND CONTROL NETWORKFOR IMMEDIATE CLOSE AIR SUPPORT

<u>EVENT NUMBERS</u>	<u>NODE</u>	<u>DESCRIPTION</u>
(R-02)-(R-01)	BN CP/TACP	Processing an initial request.
(R-14)-(R-13)	BDE CP/TACP	Processing an initial request.
(R-26)-(R-20)	BDE CP/TACP	Processing a lower echelon/ request approval by the Army.
(R-23)-(R-20)	BDE CP/TACP	Processing a lower echelon request with a cancellation by the Army.
(R-23)-(R-21)	BDE CP/TACP	Processing an abort with a cancellation decision by the Army.
(R-14)-(R-21)	BDE CP/TACP	Processing an abort with a decision by the Army to continue the mission with fixed wing resources.
(R-14)-(R-10)	DIV TOC/TACP	Processing an initial request.
(R-25)-(R-16)	DIV TOC/TACP	Processing a lower echelon request approval by the Army.
(R-19)-(R-16)	DIV TOC/TACP	Processing a lower echelon request with a cancellation by the Army.
(R-19)-(R-17)	DIV TOC/TACP	Processing an abort with a cancellation decision by the Army.
(R-11)-(R-17)	DIV TOC/TACP	Processing an abort with a decision by the Army to con- tinue the mission with fixed wing resources.
(R-05)-(R-03)	CORPS TOC/DASC	Processing a BN request for fixed wing support using DASC ground alert resources.
(R-04)-(R-03)	CORPS TOC/DASC	Processing a BN request for fixed wing support using DASC air alert/divert.
(R-29)-(R-03)	CORPS TOC/DASC	Processing a BN request for fixed wing support requesting TACC resources.
(R-05)-(R-15)	CORPS TOC/DASC	Processing a BDE request for fixed wing support using DASC ground alert resources.
(R-04)-(R-15)	CORPS TOC/DASC	Processing a BDE request for fixed wing support using DASC air alert/divert resources.

TABLE E-3 (Concluded)

<u>EVENT NUMBERS</u>	<u>NODE</u>	<u>DESCRIPTION</u>
(R-29)-(R-15)	CORPS TOC/DASC	Processing a BDE request for fixed wing support using TACC resources.
(R-05)-(R-12)	CORPS TOC/DASC	Processing a DIV request for fixed wing support using DASC ground alert resources.
(R-04)-(R-12)	CORPS TOC/DASC	Processing a DIV request for fixed wing support using DASC air alert/divert resources.
(R-29)-(R-12)	CORPS TOC/DASC	Processing a DIV request for fixed wing support using TACC resources.
(R-05)-(R-33)	CORPS TOC/DASC	Processing a CORPS request for fixed wing support using DASC ground alert resources.
(R-04)-(R-33)	CORPS TOC/DASC	Processing a CORPS request for fixed wing support using DASC air alert/divert.
R-29)-(R-33)	CORPS TOC/DASC	Processing a CORPS request for fixed wing support using TACC resources.
(R-34)-(R-12)	CORPS TOC/DASC	Processing a DIV request with a cancellation by CORPS.
(R-34)-(R-15)	CORPS TOC/DASC	Processing a BDE request with a cancellation by CORPS.
(R-34)-(R-03)	CORPS TOC/DASC	Processing a BN request with a cancellation by CORPS.
(R-34)-(R-30)	CORPS TOC/DASC	Processing an abort with a cancellation decision by CORPS.
(R-05)-(R-30)	CORPS TOC/DASC	Processing an abort with a decision to use DASC ground alert resources.
(R-04)-(R-30)	CORPS TOC/DASC	Processing an abort with a decision to use DASC air alert/divert resources.
(R-29)-(R-30)	CORPS TOC/DASC	Processing an abort with a decision to use TACC resources.

TABLE E-4

ELAPSED COMMUNICATION TIMES

ARMY/AIR FORCE COMMAND AND CONTROL NETWORKFOR IMMEDIATE CLOSE AIR SUPPORT

<u>EVENT NUMBERS</u>	<u>NODE TO NODE</u>	<u>DESCRIPTION</u>
(R-03)-(R-02)	BN CP/TACP to CORPS TOC/DASC	Initial request.
(R-03)-(R-14)	BDE CP/TACP to CORPS TOC/DASC	Initial request.
(R-15)-(R-14)	BDE CP/TACP to CORPS TOC/DASC	Override BN request with BDE resources or reschedule an aborted mission.
(R-32)-(R-23)	BDE CP/TACP to CORPS TOC/DASC	Notification of cancellation to DASC.
(R-24)-(R-23)	BDE CP/TACP to BN CP/TACP	Notification of cancellation to BN.
(E-02)-(R-14)	BDE CP/TACP to FLT LDR	Use air alert/divert resources.
(R-12)-(R-11)	DIV TOC/TACP to CORPS TOC/DASC	Initial request.
(R-12)-(R-11)	DIV TOC/TACP to CORPS TOC/DASC	Override lower echelon request with DIV resources or re- schedule an aborted mission.
(R-31)-(R-19)	DIV TOC/TACP to CORPS TOC/DASC	Notification of cancellation to DASC.
(R-22)-(R-19)	DIV TOC/TACP to BDE CP/TACP	Notification of cancellation to BDE TACP.
(R-24)-(R-19)	DIV TOC/TACP to BN CP/TACP	Notification of cancellation to BN.
(E-02)-(R-11)	DIV TOC/TACP to FLT LDR	Use air alert/divert resources.
(R-06)-(R-05)	CORPS TOC/DASC to TUOC	Use ground alert resources.
(R-08)-(R-04)	CORPS TOC/DASC to CRC/CRP	Use air alert/divert resources.
(R-27)-(R-29)	CORPS TOC/DASC to TACC	Use TACC resources.
(E-02)-(R-05)	CORPS TOC/DASC to FLT LDR	Use air alert resources.
(R-24)-(R-34)	CORPS TOC/DASC to BN CP/TACP	Cancellation of a BN request.
(R-22)-(R-34)	CORPS TOC/DASC to BDE CP/TACP	Cancellation of a BDE request.
(R-18)-(R-34)	CORPS TOC/DASC to DIV TOC/TACP	Cancellation of a DIV request.

(E-01)-(R-07)	TUOC to FLT LDR	Tasking of ground alert.
(E-02)-(R-09)	CRC/CRP to FLT LDR	Tasking of air alert/divert.
(R-06)-(R-28)	TACC to TUOC	Use ground alert resources.
(R-08)-(R-28)	TACC to CRC/ CRP	Use air alert/divert resources.
(E-18)-(R-30)	FLT LDR to CORPS TOC/DASC, CRC, CRP, ASRT, or FAC	Abort.

TABLE E-5

LINK TIMES

ARMY/AIR FORCE COMMAND AND CONTROL NETWORKFOR IMMEDIATE CLOSE AIR SUPPORT

<u>EVENT NUMBERS</u>	<u>NODE TO NODE</u>	<u>DESCRIPTION</u>
(R-03)-(R-01)	BN CP/TACP to CORPS TOC/DASC	Original request for immediate CAS from BN.
(R-32)-(R-01)	BN CP/TACP to CORPS TOC/DASC	With BDE override for use of Army resources.
(R-31)-(R-01)	BN CP/TACP to CORPS TOC/DASC	With DIV override for use of Army resources.
(R-15)-(R-13)	BDE CP/TACP to CORPS TOC/DASC	Original request for immediate CAS from BDE.
(R-31)-(R-13)	BDE CP/TACP to CORPS TOC/DASC	With DIV override for use of Army resources.
(R-31)-(E-18)	BDE CP/TACP to CORPS TOC/DASC	Abort transmitted to BDE decision to use Army resources.
(R-15)-(E-18)	BDE CP/TACP to CORPS TOC/DASC	Abort transmitted to BDE decision to continue with fixed-wing- allocated resources.
(E-02)-(E-18)	BDE CP/TACP to CORPS TOC/DASC	Abort transmitted to BDE decision to continue with fixed-wing- air alert/divert.
(R-12)-(R-10)	DIV TOC/TACP to CORPS TOC/DASC	Original request for immediate CAS from DIV.
(R-31)-(E-18)	DIV TOC/TACP to CORPS TOC/DASC	Abort transmitted to DIV decision to use Army resources.
(R-12)-(E-18)	DIV TOC/TACP to CORPS TOC/DASC	Abort transmitted to DIV decision to continue fixed-wing- allocated resources.
(E-02)-(E-18)	DIV TOC/TACP to CORPS TOC/DASC	Abort transmitted to DIV decision to continue fixed-wing-air alert/ divert resources.
(R-27)-(R-12)	CORPS TOC/DASC to TACC	Request TACC resources for DIV immediate CAS request.
(R-27)-(R-15)	CORPS TOC/DASC to TACC	Request TACC resources for BDE immediate CAS request.
(R-27)-(R-03)	CORPS TOC/DASC to TACC	Request TACC resources for BN immediate CAS request.
(R-27)-(R-33)	CORPS TOC/DASC to TACC	Request TACC resources for CORPS immediate CAS request.
(R-06)-(R-12)	CORPS TOC/DASC to TUOC	Task ground alert on DIV immediate CAS request.
(R-06)-(R-15)	CORPS TOC/DASC to TUOC	Task ground alert on BDE immediate CAS request.
(R-06)-(R-03)	CORPS TOC/DASC to TUOC	Task ground alert on BN immediate CAS request.

TABLE E-5 (Concluded)

<u>EVENT NUMBERS</u>	<u>NODE TO NODE</u>	<u>DESCRIPTION</u>
(R-06)-(R-33)	CORPS TOC/DASC to TUOC	Task ground alert on CORPS immediate CAS request.
(R-08)-(R-12)	CORPS TOC/DASC to CRC/CRP	Task air alert/divert for DIV immediate CAS request.
(R-08)-(R-15)	CORPS TOC/DASC to CRC/CRP	Task air alert/divert for BDE immediate CAS request.
(R-08)-(R-03)	CORPS TOC/DASC to CRC/CRP	Task air alert/divert for BN immediate CAS request.
(R-08)-(R-33)	CORPS TOC/DASC to CRC/CRP	Task air alert/divert for CORPS initial CAS request.
(E-02)-(R-12)	CORPS TOC/DASC to FLT LDR	Task air alert divert from DASC for DIV immediate CAS request.
(E-02)-(R-15)	CORPS TOC/DASC to FLT LDR	Task air alert direct from DASC for BDE immediate CAS request.
(E-02)-(R-03)	CORPS TOC/DASC to FLT LDR	Task air alert direct from DASC for BN immediate CAS request.
(E-02)-(R-33)	CORPS TOC/DASC to FLT LDR	Task air alert direct from DASC for CORPS immediate CAS request.
(R-06)-(R-27)	TACC to TUOC	Task ground alert.
(R-08)-(R-27)	TACC to CRC/CRP	Task air alert/divert.
(E-01)-(R-06)	TUOC to FLT LDR	Task ground alert.
(E-02)-(R-08)	CRC/CRP to FLT LDR	Task air alert/divert.

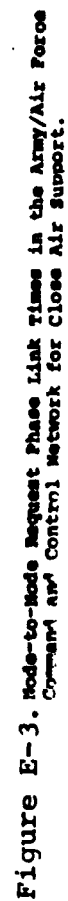
link time. The links from the DASC show the link time for a request from division, brigade, battalion and an abort reported to the DASC. The overall Request Phase time is the sum of the node-to-node link times in the path taken, i.e., the overall Request Phase time for an initial request at battalion fulfilled with a DASC allocated ground alert can be computed using the following equation: Request Phase Time = ((R-03)-(R-01))+((R-06)-(R-03))+((E-02)-(R-06)). A family of Request Phase time equations can be generated from the various node-to-node link times in Figure E-3.

(5) An elapsed time line, for purposes of analysis, of the Request Phase of a selected common CAS mission (battalion request fulfilled by allocated DASC, ground alert or air alert resources) is depicted in Figure E-4. The time scale defines six basic increments of time starting at the initial request and ending at the tasking of the delivery agent. In addition, four other aggregated elapsed times required for analysis are identified. It is recognized that several other requesting paths in the network exist. A methodology for computing the appropriate times was presented in paragraph 2e(4) above. Similar time lines may be constructed for each unique path.

f. Relationship Between Events and Data Form Questions

(1) So that the reader may correlate directly the time durations presented above with data form questions, each form/questionnaire has been numbered 1 through 11 (Annex C). The question numbers on the forms have been numbered sequentially. Table E-6 below shows where the time associated with each critical event can be found. An entry in Table E-6 of 1-11 indicates form one question 11.

(2) The defined sequence of events and time durations are selected for observation while "conditions" are changed within or among exercises in this validation. Each condition is related to an objective and may be caused to change due to influence on the exercise scenario or because of unscheduled tactical or environmental influences. Further, the mission variables listed in this chapter will cause variation in the defined times.



Request Phase Time

CP/BN TACP to
CORPS TOC/DASC
Link Time

CORPS TOC/DASC to
TUOC or CRC
Link Time

CRC or TUOC to
Flight Leader
Link Time

CORPS TOC/
DASC

BN CP/TACP
Processing
Time

Communication
Time

Processing
Time

Communication
Time

TUOC or
CRC
Processing
Time

Communication
Time

R-01 R-02 R-03 R-04 R-05 R-06 R-07 R-08 R-09 E-01 E-02

Figure E-4. Elapsed Times: Request Phase

Table E-6

ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CLOSE AIR SUPPORT
CRITICAL EVENT NO.'s VS. FORM/QUESTION NO.(S)
REQUEST PHASE

Critical Event No.	Form Question No.(s)	Critical Event No.	Form Question No.(s)
R-1	1-7	R-18	2-16, 3-24
R-2	1-8	R-19	2-7, 2-15, 3-19, 3-22
R-3	1-10, 4-6	R-20	2-5
R-4	4-8	R-21	3-8
R-5	4-8	R-22	2-16, 3-24
R-6	4-10, 5-8, 7-11	R-23	2-7, 2-15, 3-19, 3-22
R-7	5-9	R-24	2-16, 3-24
R-8	4-10, 6-8, 7-11	R-25	2-6
R-9	6-10	R-26	2-6
R-10	1-7	R-27	4-15, 7-7
R-11	1-8, 2-7, 2-9, 3-11, 3-15	R-28	7-9
R-12	1-10, 2-8, 3-17, 4-6	R-29	4-13
R-13	1-7	R-30	3-8, 4-18
R-14	1-8, 2-7, 2-9, 3-11, 3-15	R-31	2-8, 3-21, 4-20
R-15	1-10, 2-8, 3-17, 4-6	R-32	2-8, 3-21, 4-20
R-16	2-5	R-33	1-7
R-17	3-8	R-34	3-22

3. THE ARMY COMMAND AND CONTROL NETWORK FOR ATTACK HELICOPTER CLOSE AIR SUPPORT.

a. General. Close air support constitutes only one element of the means available to assist the ground force commander in accomplishing his mission. Based on the mission and forces available, the commander will task organize his units into brigade, battalion, or company size forces to include supporting fire elements. Attack helicopters, whether organic or operating in support of a ground tactical force, are treated as any other fire and maneuver element of the combined arms team. The control of attack helicopters is simplified within the combat task force organization and is accomplished through the standard Army Command and Control System at a low level of command. This network is designed to provide responsiveness, continuity, and freedom of action to frontline commanders through the tailoring of elements to include attack helicopters, thus assuring maximum decentralized execution of combat tasks. Figure E-5 portrays this network and depicts the key inter-relationships for command and control of Attack Helicopters (AH).

b. Attack Helicopter Employment.

(1) Army concept of employment for Attack Helicopter and Air Cavalry units is based upon decentralized control to the lowest levels practicable consistent with assigned missions, available forces and enemy capabilities. Ultimate control is normally at maneuver battalion level and lower. Procedurally, AH units are placed under operational control of the maneuver commander. Command is retained by the major tactical unit owning AH assets. Changes in task organization are accomplished through adjustments in command relationship facilitated by fragmentary orders based upon changes in the commander's concept of the operation. The change in task organization may be prompted by a request from a subordinate, adjacent or higher level organization or based solely on a revised commander's concept.

(2) Aerial Field Artillery (AFA) is employed to augment and extend the capability of field artillery to provide immediate responsive fire support to the maneuver commander. AFA units differ from Attack Helicopter and Air Cavalry units primarily in armament and in tactical employment. AFA units are viewed as fire support units and as such are rarely tasked organized with maneuver forces. Normally they are assigned tactical artillery missions: Reinforcing (R), General Support (GS), etc., and respond to requests for fire support passed over standard field artillery fire request channels.

c. General Guidance. The general guidance in the Detailed Test Plan (DTP) has been expanded as follows:

(1) In assessing the performance of the Army command and control network for attack helicopters, the start time in the Request Phase is defined as the time a request for CAS is acknowledged or originated at a company/troop CP. While some requests for immediate direct aerial fires (CAS) do originate at battalion level, they routinely originate at lower levels and are more frequently controlled at those lower levels.

(2) Specific reference to attack helicopter units designated Attack Helicopter, Air Cavalry and Aerial Field Artillery is made for clarification. Recognition is made of the use of standard field artillery fire support request channels for Aerial Field Artillery (AFA) direct aerial fires. All previously published guidance has been general in reference to the Army Command and Control Network for AH CAS citing only major command echelons, as elements in that network (Figure E-6). Specific designation of operational elements within the Command and Control Network for Army Attack Helicopter CAS was essential prior to attempting to collect data under field exercise conditions. The Detailed Analysis Plan specifies and refines general guidance contained in the DTP concerning data necessary to reconstruct an attack helicopter immediate CAS mission. All standard mission request routings and execution paths are included.

d. Command and Control Network for Close Air Support.

(1) Close air support is categorized as preplanned and immediate.

3. The prevailing tactical situation determines which organizations depicted below will have control of attack helicopter assets.

4. Controller may be a company commander, squad leader, platoon leader, F. O., scout helicopter or another attack helicopter.
 5. ADDED: Heavy lines depict the representative paths used in JSTF CAS STUDY PHASE II which will be highlighted in the CAS Validation Program. Nodes (F1), (F2), and (F3) are added.
- Alphanumeric codes are those used in JSTF CAS Study, Phase II.

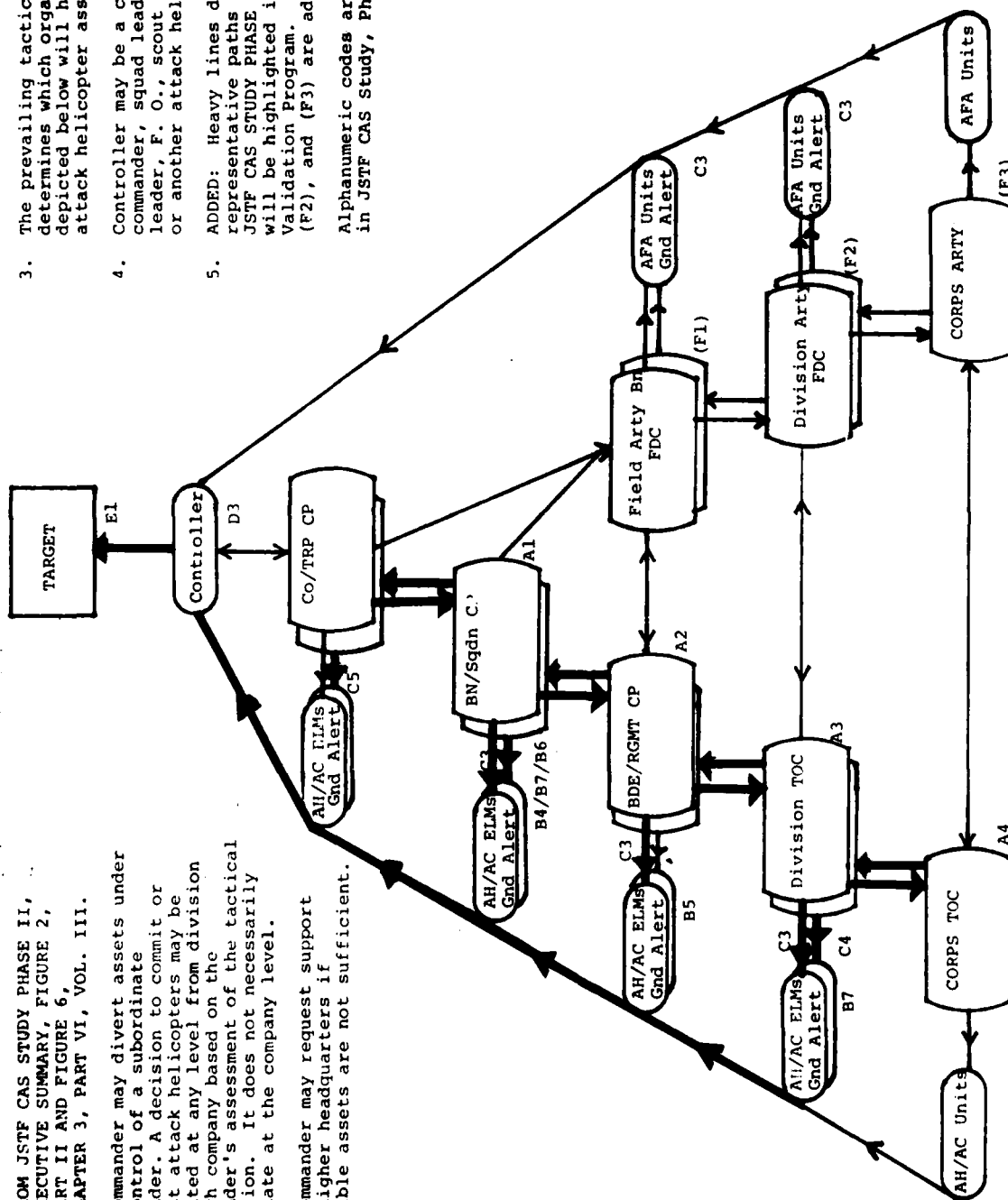


Figure 7-5. Army Command and Control Network for Attack Helicopter CAS

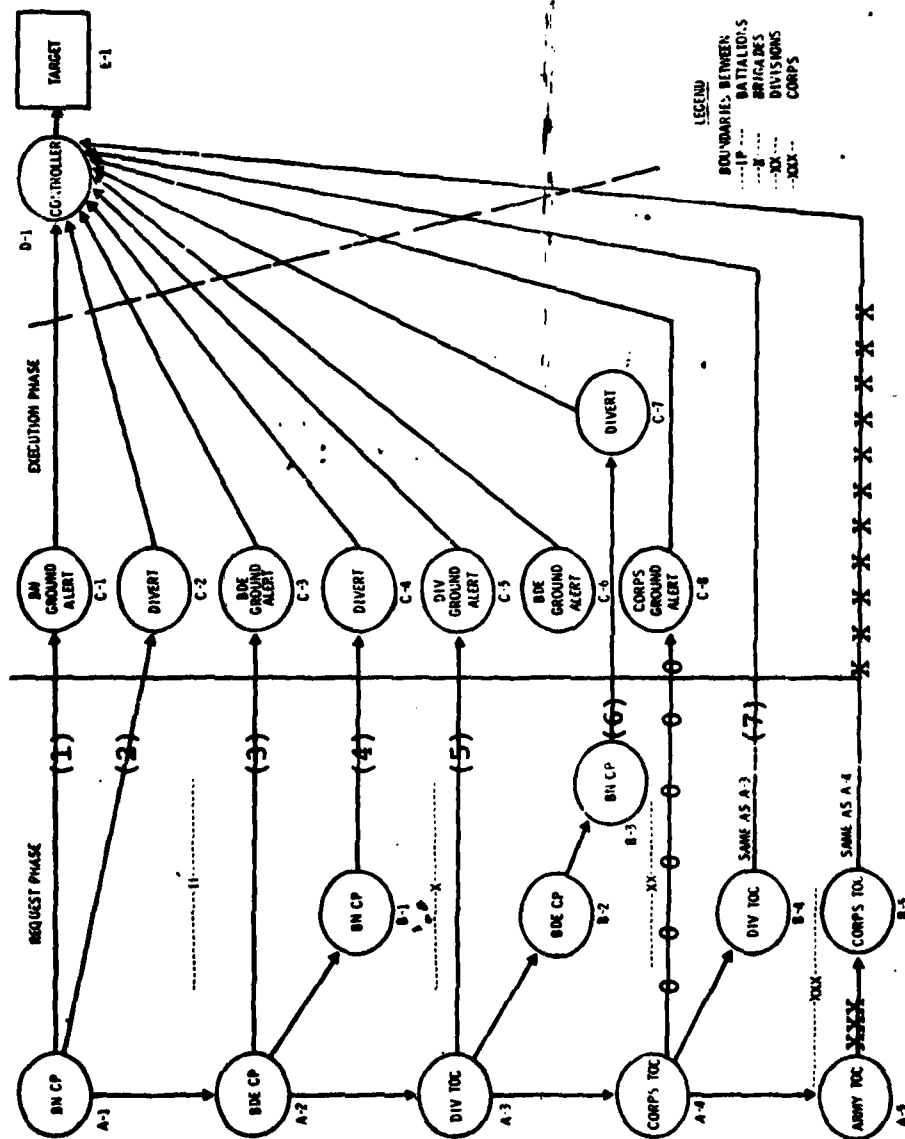


Figure E-6. Army Attack Helicopter Command and Control Network

NOTES:

1. XXX indicates path not included in JSTF CAS Study, Phase II
2. 000 indicates not included in representative paths used for compilation of response times cited in Figure 6, Chapter 3, Part VI, VOL III, JSTF CAS Study Phase II.
3. (N) indicates those representative paths used in reference cited in 2 above to provide staff estimated response times.
4. Nodes titled DIVERT refer to companies.

Attack helicopter CAS is not normally preplanned on a fire mission/sortie basis. Preplanning is accomplished through standard mission analysis and task organization of forces to support the maneuver commander's concept of operation. When attack helicopters are included in the task organization, placed under operational control or in support of the ground force, their fires are integrated with the plan of maneuver and all other planned fires. This is routinely accomplished through direct liaison from the attack helicopter unit to the supported force commander as early as possible during planning for the operation.

(2) Immediate requests or requirements are handled by the most direct control procedures and communications means available. If attack helicopter assets are not under the direct control of the force commander, but are available at a higher echelon of command, or through a supporting echelon, the most expeditious procedures and communications are used for processing requests and controlling missions. The handling of these immediate requirements for attack helicopter direct aerial fires (CAS), is the subject addressed in this section.

(3) Throughout the CAS Validation Program, emphasis will be placed on gathering that data directly comparable to the paths through the Attack Helicopter Command and Control Network identified in the JSTF CAS Study, Phase II. Data will be collected on all attack helicopter missions including aerial field artillery requested at company level which are coordinated/integrated at battalion level or higher. Figure E-7 depicts the attack helicopter request net.

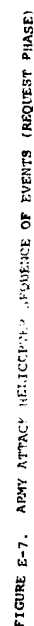
(4) While the CORPS TOC and Corps Artillery are included in the command and control network, their involvement in providing immediate attack helicopter CAS is infrequent. Should the tactical situation dictate, corps could withdraw assets from one division and place them under the control of another, or commit AH assets retained under corps control. This relocation of attack helicopter assets is normally accomplished on a preplanned basis, i.e., through task organization.

(5) There are many paths through the network shown in Figure E-5. Six paths were chosen for highlighting in the CAS Validation Program. These are identified in Figure E-5 with bold connecting links. A tabular description of these paths is contained in Table E-7. These are the first six of seven paths identified in JSTF CAS Study, Phase II, Chapter 3, Part VI, and will be emphasized during exercise scenario development and field data collection. Path number seven (7) (Figure E-5) will, in all probability, not be exercised during training exercises. The data collection system and analysis methodology are not restricted to these six paths. All others, where sufficient data exists, will be analyzed.

e. The Army Attack Helicopter Sequence of Critical Events (Request Phase).

(1) The Request Phase includes all of the actions directly related to CAS request processing including request evaluation, fire support, air defense and airspace coordination, decision-making, mission assignment and communications through all command and control elements involved. The Request Phase starts upon acknowledgement or origination of a request for attack helicopter direct aerial fires (CAS) at the Company/Troop CP (R-01). The Request Phase ends upon acknowledgement of the order to execute the mission by the Flight Leader (E1 to E2).

(2) The simplified illustration of Army attack helicopter request channels depicted in the JSTF CAS Study Phase II and in Figure E-6 were used as basis for construction of a CAS Request Phase Sequence of Events diagram (Figure E-7). This diagram is composed of basically two types of events. These are: The times that each action element in the network acknowledges receipt of a CAS request/order, e.g. (BN CP R-07); and the time of first attempt to transmit instructions responding to the acknowledged message to the next element in the command and control network, e.g. (BN CP R-08). These are the times which will be collected for analysis of immediate CAS mission response times as described in this section.



(c) All technicians may initiate requests/orders/cancellations/disapprovals as appropriate.

(3) Approved requests result in the use of ground alert (E-1) or airborne divert aircraft (E-2). If assets are not available under the direct control of the command element receiving the request, required support can be provided by the withdrawal of attack helicopters from one subordinate unit to support another through change in OPCON status, e.g., (R-8/R-1); or through forwarding a request for attack helicopter CAS to a supporting element or higher command echelon. The requestor is normally notified concerning the method selected for meeting the request and contact instructions for control of the means provided. The initiator may cancel a CAS request. Any higher command echelon may disapprove a request, e.g., (R-07). Communication of these actions is accomplished through the use of the normal command/control/fire support networks.

(4) There are many possible alternate routes of communication. All possible alternatives have not been included in the diagram, but provisions are made for collecting this information in the data form questions. Principal among these are all nets other than the primary command/operations/fire request nets which also link the elements concerned. Additionally, cancellations, disapprovals and/or delays may occur between or within organizational elements. The data form questions have been designed to record these actions and the reasons therefor. As previously indicated in Chapter III, certain factors may be controlled through exercise scenario influence as departures from a selected Base Case so that adequate data will be available to assess the effects on response times consistent with the CAS validation objectives. Uncontrolled factors (mission variables) will be recorded so that their effect on the performance of command and control networks may be assessed within sample size constraints. Typical of such factors are: Mission of supported unit; the tactical ground battle situation, i.e., attack, defense, retrograde; attack helicopter unit tactical mission or OPCON status; state of aircraft readiness, including degree of aircraft ground alert; operational status of command and control system equipments; type terrain, i.e., open or cluttered; and command and control element workload. The data form questions are designed to collect this type information at the applicable elements of the command and control network for attack helicopter CAS. Annex B, Appendix II, contains these data form questions.

e. Event Definitions. The events depicted in Figure E-7 have been designated R-01 to R-30, E-01, E-02. Their definitions are contained in Table E-8.

f. Elapsed Times Between Specified Events. Elapsed times have been defined for processing times within a command and control node and communication from node-to-node. The link times are a summation of the processing time at one node with the communication time to the next node. The Request Phase elapsed time is a summation of the link elapsed times for a particular mission. This macro breakdown was selected to provide flexibility for analysis.

(1) The principal elapsed processing times for each node are contained in Table E-9.

(2) The principal elapsed node-to-node communication times are contained in Table E-10.

(3) The principal elapsed link times are contained in Table E-11.

(4) The relationships between events illustrated in Figure E-7 and the data form questions (Annex C, Appendix II) are contained in Table E-12.

TABLE E-7
PRIMARY NETWORK PATHS FOR ANALYSIS
ARMY COMMAND AND CONTROL NETWORK
ATTACK HELICOPTER CLOSE AIR SUPPORT

<u>PATH NUMBER</u>	<u>PATH SEQUENCE</u>	<u>PATH DESCRIPTION</u>
1	A1-C3-D3-E1	BN CP meets requirement with AH under BN control - ground alert.
2	A1-C5-D3-E1	BN CP meets requirement by diverting AH under control of adjacent company.
3	A1-A2-C3-D3-E1	BN CP requests AH from BDE. BDE meets requirement with ground alert.
4	A1-A2-B4-C5-D3-E1	BN CP requests AH from BDE. BDE meets requirement by tasking adjacent BN to provide AH. BN meets requirement by diverting AH under control of adjacent company or ground alert.
5	A1-A2-A3-C3-D3-E1	BN CP requests AH from BDE. BDE passes request to Division. Division meets requirement with AH under Division control - ground alert.
6	A1-A2-A3-B5-B6-C5-D3-E1	BN CP requests AH from BDE. BDE passes request to Division. Division meets requirement by tasking adjacent BDE to provide AH. BDE tasks adjacent BN; BN diverts AH under control of adjacent company or ground alert.
7	A1-A2-A3-A4-B7-C4-D3-E1	BN CP requests AH from BDE, BDE passes request to Division, Division passes request to Corps. Corps tasks adjacent Division. Division meets requirement with AH under Division control - ground alert.

TABLE E-8

EVENT DEFINITIONS

ARMY COMMAND AND CONTROL NETWORKATTACK HELICOPTER CLOSE AIR SUPPORT

<u>EVENT</u>	<u>DEFINITION</u>
R-01	Time that a company/troop CP acknowledged or originated a request/requirement for CAS.
R-02	Time of first attempt by company/troop CP to transmit request/order for CAS.
R-03-C	Time that a company/troop attack helicopter control element acknowledged receipt of a request/requirement for Attack Helicopter CAS.
R-03-F	Time that a field artillery FDC acknowledged receipt of a request for AH CAS.
R-04-C	Time of first attempt by Attack Helicopter launch site to transmit order to flight leader.
R-04-F	Time of first attempt by field artillery FDC to transmit order to AFA launch site.
R-05-F	Time that the AFA launch site acknowledged receipt of an order for AH CAS.
R-06-F	Time of first attempt by AFA launch site to transmit order to flight leader.
R-07	Time that the BN CP acknowledged receipt of a request for CAS.
R-08	Time of first attempt by BN CP to transmit request/order for CAS.
R-09-C	Time Attack Helicopter launch site acknowledged receipt of order.
R-09-F	Time that a field artillery FDC acknowledged receipt of a request for AH CAS.
R-10-C	Time of first attempt by Attack Helicopter launch site to transmit order to flight leader.
R-10-F	Time of first attempt by field artillery FDC to transmit order to AFA launch site.
R-11-F	Time that the AFA launch site acknowledged receipt of an order for AH CAS.
R-11-F	Time of first attempt by AFA launch site to transmit order to flight leader.
R-13	Time that the BDE CP acknowledged receipt of a request for CAS.
R-14	Time of first attempt by BDE CP to transmit request/order for CAS.
R-15-C	Time Attack Helicopter launch site acknowledged receipt of order.

Table E-8 (Concluded)

R-15-F	Time that a field artillery FDC acknowledged receipt of a request for AH CAS.
R-16-C	Time of first attempt by Attack Helicopter launch site to transmit order to flight leader.
R-16-F	Time of first attempt by a field artillery FDC to transmit order to AFA launch site.
R-17-F	Time that the AFA launch site acknowledged receipt of an order for AH CAS.
R-18-F	Time of first attempt by AFA launch site to transmit order to flight leader.
R-19	Time that the DTOC acknowledged receipt of a request for CAS.
R-20	Time of first attempt by DTOC to transmit request order for CAS.
R-21-C	Time Attack Helicopter launch site acknowledged receipt of order.
R-21-F	Time that a field artillery FDC acknowledged receipt of a request for AH CAS.
R-22-C	Time of first attempt by Attack Helicopter launch site to transmit order to flight leader.
R-22-F	Time of first attempt by a field artillery FDC to transmit request/order to AFA launch site.
R-23-F	Time that the AFA launch site acknowledged receipt of a request/order for AH CAS.
R-24-F	Time of first attempt by AFA launch site to transmit order to flight leader.
R-25	Time that the CTOC acknowledged receipt of a request for CAS.
R-26	Time of first attempt by CTOC to transmit request/order for CAS.
R-27-C	Time Attack Helicopter launch site acknowledged receipt of order.
R-27-F	Time that a field artillery FDC acknowledged receipt of a request for AH CAS.
R-28-C	Time of first attempt by Attack Helicopter launch site to transmit order to flight leader.
R-28-F	Time of first attempt by field artillery FDC to transmit order to AFA launch site.
R-29-F	Time that the AFA launch site acknowledged receipt of an order for AH CAS.
R-30-F	Time of first attempt by AFA launch site to transmit order to flight leader.
E-1	The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order.
E-2	The time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission.

TABLE E-9
ELAPSED PROCESSING TIMES*
ARMY COMMAND AND CONTROL NETWORK

ATTACK HELICOPTER CLOSE AIR SUPPORT

<u>EVENT NUMBERS</u>	<u>NODE</u>	<u>DESCRIPTION</u>
(R-02)-(R-01)	CO/TRP CP-Element	Processing an initial request/order.
(R-04-C)-(R-03-C)	CO/TRP AH Launch Site	Processing an initial order.
(R-04-F)-(R-03-F)	Field Artillery FDC	Processing an initial request.
(R-06-F)-(R-05-F)	AFA Launch Site	Processing an initial order.
(R-08)-(R-07)	BN/SQDN CP	Processing an initial request/order.
(R-10-C)-(R-09-C)	BN/SQDN AH Launch Site	Processing an initial order.
(R-10-F)-(R-09-F)	Field Artillery FDC	Processing an initial request.
(R-12-F)-(R-11-F)	AFA Launch Site	Processing an initial order.
(R-14)-(R-13)	BDE CP	Processing an initial request/order.
(R-16-C)-(R-15-C)	BDE AH Launch Site	Processing an initial order.
(R-16-F)-(R-15-F)	Field Artillery FDC	Processing an initial request.
(R-18-F)-(R-17-F)	AFA Launch Site	Processing an initial order.
(R-20)-(R-19)	DTOC	Processing an initial request/order.
(R-22-C)-(R-21-C)	DIV AH Launch Site	Processing an initial order.
(R-22-F)-(R-21-F)	Field Artillery FDC	Processing an initial request.
(R-24-F)-(R-23-F)	AFA Launch Site	Processing an initial order.
(R-26)-(R-25)	CTOC	Processing an initial request/order.

* Cancellations, disapprovals and aborts are also processed at these nodes.

TABLE E-10
ELAPSED COMMUNICATION TIMES*
ARMY COMMAND AND CONTROL NETWORK
ATTACK HELICOPTER CLOSE AIR SUPPORT

<u>EVENT NUMBERS</u>	<u>NODE TO NODE</u>	<u>DESCRIPTION</u>
(R-03-C)-(R-02)	CO/TRP CP to AH Ground Alert	Initial Order
(R-03-F)-(R-02)	CO/TRP CP to Field Artillery FDC	Initial Request
(R-05-F)-(R-02)	CO/TRP CP to AFA Ground Alert	Initial Order
(E-1) or (E-2)- (R-02)	CO/TRP CP to Flight Leader	Initial Order
(E-1) or (E-2)- (R-04-C)	AH Ground Alert to Flight Leader	Initial Order
(R-05-F)-(R-04-F)	Field Artillery FDC to AFA Ground Alert	Initial Order
(E-1) or (E-2) - (R-06-F)	AFA Ground Alert to Flight Leader	Initial Order
(R-07)-(R-02)	CO/TRP CP to BN/SQDN CP	Initial Request
(R-09-C)-(R-08)	BN/SQDN CP to AH Ground Alert	Initial Order
(R-09-F)-(R-08)	BN/SQDN CP to Field Artillery FDC	Initial Request
(R-11-F)-(R-08)	BN/SQDN CP to AFA Ground Alert	Initial Order
(E-1) or (E-2) - (R-08)	BN/SQDN CP to Flight Leader	Initial Order
(E-1) or (E-2) - (R-10-C)	AH Ground Alert to Flight Leader	Initial Order
(R-11-F)-(R-10-F)	Field Artillery FDC to AFA Ground Alert	Initial Order
(E-1) or (E-2) - (R-12-F)	AFA Ground Alert to Flight Leader	Initial Order
(R-13)-(R-08)	BN/SQDN CP to BDE/RGMT CP	Initial Request
(R-15-C)-(R-14)	BDE/RGMT to AH Ground Alert	Initial Order
(R-15-F)-(R-14)	BDE/RGMT to Field Artillery FDC	Initial Request
(R-17-F)-(R-14)	BDE/RGMT to AFA Ground Alert	Initial Order
(E-1) or (E-2) - (R-14)	BDE/RGMT CP to Flight Leader	Initial Order
(E-1) or (E-2) - (R-16-C)	AH Ground Alert to Flight Leader	Initial Order
(R-17-F)-(R-16-F)	Field Artillery FDC to AFA Ground Alert	Initial Order

<u>EVENT NUMBERS</u>	<u>NODE</u>	<u>DESCRIPTION</u>
(E-1) or (E-2) - (R-18-F)	AFA Ground Alert to Flight Leader	Initial Order
(R-19)-(R-14)	BDE/RGMT CP to DTOC	Initial Request
(R-21-C)-(R-20)	DTOC to AH Ground Alert	Initial Order
(R-21-F)-(R-20)	DTOC to Fld Arty FDC	Initial Request
(R-23-F)-(R-20)	DTOC to AFA Gnd Alert	Initial Order
(E-1) or (E-2) - (R-20)	DTOC to Flt Ldr	Initial Order
(E-1) or (E-2) - (R-22-C)	AH Gnd Alert to Flt Ldr	Initial Order
(R-23-F)-(R-22-F)	Field Arty FDC to AFA Gnd Alert	Initial Order
(E-1) or (E-2) - (R-24-F)	AFA Gnd Alert to Flt Ldr	Initial Order
(R-25)-(R-20)	DTOC to CTOC	Initial Request
(R-27C)-(R-26)	CTOC to AH Gnd Alert	Initial Order
(R-27-F)-(R-26)	CTOC to Fld Arty FDC	Initial Request
(R-29-F)-(R-26)	CTOC to AFA Gnd Alert	Initial Order
(E-1) or (E-2) - (R-26)	CTOC to Flt Ldr	Initial Order
(E-1) or (E-2) - (R-28-C)	AH Ground Alert to Flt Ldr	Initial Order
(R-29-F)-(R-28-F)	Field Arty FDC to AFA Gnd Alert	Initial Order
(E-1) or (E-2) - (R-30-F)	AFA Gnd Alert to Flt Ldr	Initial Order

*Cancellations, disapprovals and aborts are also communicated through these node-to-node communications links.

TABLE E-11

LINK TIMES

ARMY COMMAND AND CONTROL NETWORKATTACK HELICOPTER CLOSE AIR SUPPORT

<u>LINK TIME</u>	<u>DESCRIPTION</u>
(R-03-C)-(R-01)	Co/TRP CP to AH Ground Alert.
(R-03-F)-(R-01)	Co/TRP CP to Field Artillery FDC.
(E-1) or (E-2)-(R-03-C)	Co/TRP AH unit to flight leader.
(R-05-F)-(R-03-F)	Field Artillery FDC to AFA Ground Alert.
(E-1)-(R-05-F)	AFA Unit to flight leader.
(R-07)-(R-01)	Co/TRP CP to BN/SQDN CP.
(R-09)-(R-07)	BN/SQDN CP to AH unit.

(Descriptions are similar at BN, BDE, DIV and CORPS. Refer to figure E-8)

TABLE E-12

ARMY COMMAND AND CONTROL NETWORK
ATTACK HELICOPTER CLOSE AIR SUPPORT
 CRITICAL EVENT NO.'S VS. DATA FORM
 QUESTION NO.(S) REQUEST PHASE

Critical Event No.	Form - Question No(s)	Critical Event No.	Form Question No(s)
R-01	1-11	R-16-C	9-14
R-02	1-14	R-16-F	6-14
R-03-C	1-15, 7-13	R-17-F	6-15
R-03-F	1-15, 6-11	R-18-F	7-14
R-04-C	7-14	R-19	4-11
R-04-F	6-14	R-20	R-14
R-05-F	6-15	R-21-C	4-15, 7-13
R-06-F	7-14	R-21-F	4-15, 6-11
R-07	2-11	R-22-C	10-14
R-08	2-14	R-22-F	6-14
R-09-C	2-15, 7-13	R-23-F	6-15
R-09-F	2-15, 6-11	R-24-F	7-14
R-10-C	8-14	R-25	5-11
R-10-F	6-14	R-26	5-14
R-11-F	6-15	R-27-C	5-15, 7-13
R-12-F	7-14	R-27-F	5-15, 6-11
R-13	3-11	R-28-C	11-14
R-14	3-14	R-28-F	6-14
R-15-C	3-15, 7-13	R-29-F	6-15
R-15-F	3-15, 6-11	R-30-F	7-14

4. NAVY-MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS.

a. General Description.

(1) Figure E-8 is a simplified schematic representation of the Navy-Marine Corps Command and Control Network for CAS. This schematic was employed in the JSTF CAS Study Phase II and identifies the principal agencies for command and control of CAS.

(2) The schematic representation of the network shows links between the Battalion CP (A-1) and Ground Alert Forward (C-1), and the Regiment CP (A-5) and Ground Alert Forward (C-1). Control of Ground Alert Forward aircraft (C-1) at Battalion (A-1) and Regiment (A-5) is a concept under study and is not approved doctrine at this time. Present doctrine specifies that launch authority for Ground Alert Forward aircraft is the responsibility of the DASC (A-2), TACC (A-3), or the TACC (Control Afloat) (A-3). Following discussions are based on current doctrine.

(3) The senior agency in the command and control network is the Tactical Air Control Center (TACC) (A-3) afloat, or, when control is ashore, is the Tactical Air Command Center (TACC) (A-3). The TACC is the facility through which the tactical commander exercises control, coordination, and overall management of tactical air operations. During an amphibious operation, either agency will be referred to as a Tactical Air Direction Center (TADC) when designated as the secondary/back up agency to the TACC having control.

(4) When control is ashore, the agency which provides direction for all offensive air operations is the Direct Air Support Center (DASC) (A-2). It is responsible to the tactical air commander for the control of all air support operations to include close air support, assault support, aerial reconnaissance missions and helicopter operations.

(5) The agency responsible for the control and coordination of air defense operations (control ashore) is the Tactical Air Operation Center (TAOC) (B-1). This agency provides surveillance, air traffic management and control, and control of interceptors and surface-to-air missiles in defense of the landing force.

(6) Subordinate to the DASC (A-2) are agencies which provide terminal control of air support missions. Among these agencies are the Tactical Air Control Parties (TACP), which are organic to the ground maneuver elements of the landing force. There are thirteen TACPs within a Marine Division, one at each Infantry Battalion (A-1), Regimental (A-5), and Division Headquarters (A-6). At Battalion level (A-1), the TACP consists of an Air Liaison Officer (ALO) who assists and advises the battalion commander and two Forward Air Controllers (FAC). The FACs operate with companies to request air support and provide visual control of aircraft conducting CAS strikes.

(7) The Air Support Radar Team (ASRT) (D-2) is a terminal air support control agency subordinate to the DASC (A-2), which provides precision radar tracking and positioning of aircraft for all weather ordnance delivery.

(8) Another method of all-weather ordnance delivery is employed by A6 attack aircraft using offset bombing capability. With this method, the bombardier/navigator inserts target range and azimuth information from a ground reference point into his aircraft computer. The aircraft computer will then guide the aircraft to a predetermined point and the pilot can drop his ordnance on target. The reference point may be a radar beacon FAC, called "RABFAC" or a radar significant feature on the ground.

(9) In addition to the ground terminal agencies previously mentioned, the command and control system for CAS also employs airborne terminal control agencies. A Forward Air Controller Airborne (FAC(A)) or a Tactical Air Coordinator Airborne (TAC(A)) is employed in situations when it is not feasible or desirable to utilize control from a ground agency.

(10) The last agency is the Marine Air Traffic Control Unit (MATCU). This agency does not function within the two principal categories of air support or air defense but does play an important role in command and control. The MATCU is found in the Marine Air Base Squadron of the Marine Air Group (MAG) and is organized and equipped with expeditionary terminal control facilities to launch and recover aircraft. In order to provide terminal and limited en route aircraft control, the MATCU is organized in three sections: approach control, GCA and control tower. All sections coordinate closely with the TAOC to insure positive control of aircraft throughout a flight.

b. Preplanned Missions. CAS missions are divided into two categories: preplanned and immediate. Preplanned missions are those which are requested sufficiently in advance to permit detailed planning and briefing of pilots prior to take-off. When control is afloat, requests for CAS are forwarded by the Landing Force Commander to TACC afloat. When control is ashore, requests are received from ground units, processed by the Division FSCC, and then submitted to the Wing G-3. Based on the air assets available, a daily fragmentary order (FRAG) is prepared by the TACC afloat, or the Wing G-3, scheduling those air support missions which can be accomplished.

c. Immediate CAS Missions.

(1) During the initial ship-to-shore movement of the assault force, air command and control within the Amphibious Objective Area (AOA) is exercised by the Commander, Amphibious Task Force (CATF) from the TACC afloat (A-3). Long range radar surveillance for air defense of the Amphibious Task Force (ATF) is provided by ships radar and Airborne Early Warning (AEW) aircraft. Combat Air Patrol (CAP) aircraft are airborne or on deck alert ready to intercept hostile aircraft.

(2) As the Assault Landing Force moves ashore, Forward Air Controllers (FAC) with Tactical Air Control Parties (TACP) request air support directly from the TACC afloat. The TACC (A-3) afloat coordinates these requests with the Supporting Arms Coordination Center (SACC) (A-3) and, if approved, will provide deck alert or air alert aircraft. Battalion and Regimental Fire Support Coordination Centers (FSCC) (A-1) (A-5), (A-6) monitor the requests and communicate only if there is an objection.

(3) When control is ashore, requests are received by the DASC (A-2) directly from FACs (A-1) with the front line ground units. Battalion (A-1) and Regimental (A-5) FSCCs monitor the requests and communicate only if there is an objection. The DASC coordinates the request with Division FSCC (A-6) and, if approved, will provide aircraft. If the DASC (A-2) assets are exceeded, it will forward the CAS request to the TACC (A-3). If approved, the TACC will provide air/ground/deck alert aircraft or divert aircraft. The TACC will transmit requests for deck alert launch directly to the CVA or for relay through the TADC(A) (A-4).

d. Sequence of Events: Request Phase (Control Afloat).

(1) The sequence of events for the Request Phase (Control Afloat) for an immediate CAS mission is illustrated in Figure E-9. The Request Phase begins when the FAC, or others listed under event R-2, initiates a Tactical Air Request (TAR). The Request Phase ends with acknowledgement of a launch order by the flight leader for ground/deck alert (E-1) or acknowledgement of receipt of an execution order by the flight leader in the case of air alert or diverted flights (E-2).

(2) After the FAC is directed to initiate a TAR, he would then establish communications with SACC (R-1), and transmit the TAR directly to SACC (R-2) employing the primary means of communication. An alternate communications path would be a relay via the FSCCs ashore. Alternate communications paths are not indicated in Figure E-9; however, the data collection forms (Annex C, Appendix III) have been designed to record use of primary and alternate communications paths. Upon acknowledgement of the TAR at the SACC (R-3), supporting arms coordination actions would be performed and the request approved or disapproved by the Supporting Arms Coordinator (SAC) (R-4). If disapproved, appropriate

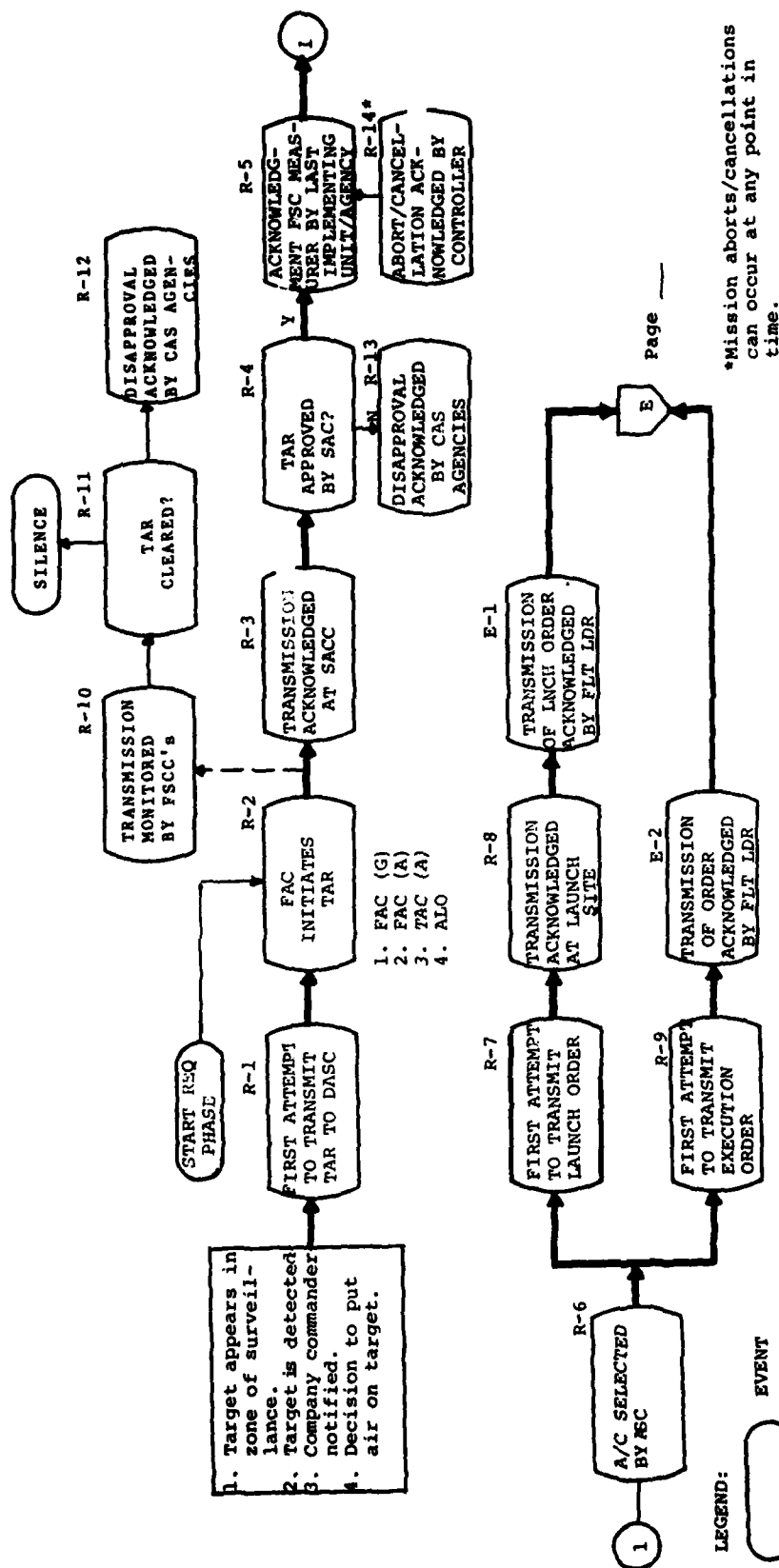


Figure E-9. Sequence of Events for the Request Phase (Control Afloat).

agencies would be notified (R-13). If Restrictive Fire or Air Plans have to be placed in effect, the request would not be cleared until the last unit/agency acknowledges receipt of the plan(s) (R-5). Aircraft would then be selected (Ground/Deck or Air Alert) to fill the request (R-6).

(3) A launch order then would be transmitted to the launch site in the event ground/deck alert aircraft are selected (R-7). After acknowledgement of the order at the site (R-8), the order would be transmitted to the flight leader and acknowledged (E-1). In the case of air alert or diverted flights, the execution order would be transmitted to the flight leader (R-9) and acknowledged (E-2).

(4) FSCC monitor functions are indicated by the events R-10, R-11, and R-12. If the TAR is cleared by the FSCCs, silence indicates approval.

(5) In the event that an assigned mission is aborted (R-14) and the request is not cancelled, the TACC would select another flight of aircraft to fill the request.

e. Request Phase: Event Definitions (Control Afloat). For purposes of analysis and formulation of data form questions, the events identified in Figure E-9 are defined in Table E-13.

f. Elapsed Times Between Critical Events (Control Afloat). The elapsed times for the Request Phase (Control Afloat) are defined in Tables E-14 through E-16. The principal sequence of elapsed times is illustrated in Figure E-10.

g. Events and Data Form Questions (Control Afloat). The definitions of the events listed in previous sections were used to formulate data form questions for the Navy/Marine Corps network. Table E-17 correlates critical events and data form number and question. The data form questions are given in Annex C, Appendix III.

h. Request Phase (Control Ashore)

(1) The sequence of events for the Request Phase (Control Ashore) is illustrated in Figure E-11. The Request Phase begins when the FAC, or others listed under the event R-2, initiates a Tactical Air Request (TAR). The Request Phase ends with the acknowledgement of a launch order by the flight leader for ground alert (E-01) or acknowledgement of receipt of an execution order in the case of air alert or diverted flights (E-02). The primary path for the Request Phase is indicated by the bold connecting lines. This path indicates the sequence of events for employment of CAS aircraft controlled by the DASC.

(2) A deviation from the primary path will occur at the DASC (R-04) if the DASC does not have sufficient assets to fill a TAR. This path is indicated by the light connecting lines for the sequence of events R-04, R-08, R-09, etc.

(3) As indicated above, the Request Phase starts when the FAC initiates a TAR (R-02). The FAC transmits the TAR directly to the DASC, employing the primary means of communications. An alternate communications path would be a relay through the Battalion or Regiment FSCCs. Alternate communications paths are not indicated in Figure E-11. However, the data collection forms (Annex C, Appendix III) have been designed to indicate usage of alternate communications paths. After acknowledgement of a request at the DASC (R-03), aircraft would be selected to fill the request (R-05), if available (R-04). The order would then be transmitted to the launch site (R-6, R-7) in the event ground alert or ground alert forward aircraft are selected, or to the flight leader in the case air alert aircraft are selected (E-2). In the case of ground alert, the Request Phase ends when the launch order is received by the flight leader (E-1).

(4) In the event the DASCs assets are exceeded, the DASC may elect to hold the TAR (R-08) until assets are available or transmit the request to the TACC (R-09). After acknowledgement of a request at the TACC (R-10), aircraft would be selected (R-11) and the order transmitted to appropriate agencies

TABLE E-13

REQUEST PHASE EVENT DEFINITIONS:

NAVY/MARINE CORPS COMMAND AND CONTROL

NETWORK FOR CAS (CONTROL AFLOAT)

<u>EVENT NUMBER</u>	<u>DEFINITION</u>
R-01	The time at which the FAC(G), FAC(A), TAC(A) or ALO first attempts to transmit.
R-02	The time at which the FAC(G), FAC(A), TAC(A) or ALO begins transmission of the TAR.
R-03	The time at which the SACC acknowledges receipt of the TAR (after read back).
R-04	The time at which the TAR is approved or disapproved Supporting Arms Coordinator (SAC).
R-05	The time that the last implementing agency acknowledges receipt of a fire support coordinating measure.
R-06	The time at which an aircraft event number is assigned to the mission.
R-07	The time at which the TACC first attempts to transmit the launch order to the launch site.
R-08	The time at which the launch site acknowledges receipt of the launch order (after read back).
R-09	The time at which the TACC first attempts to transmit a mission order to a flight leader.
R-10	The time at which the FSCC completes monitoring a TAR.
R-11	The time at which fire support coordination is completed and the TAR is cleared.
R-12	The times at which CAS agencies acknowledge disapproval of a TAR by an FSCC.
R-13	The times at which CAS agencies acknowledge approval/ disapproval of a TAR by the SACC.
R-14	The time at which a mission abort/cancellation is acknowledged by the TACC controller.

TABLE E-14

ELAPSED TIMES: REQUEST PHASE PROCESSING TIMES (CONTROL AFLOAT)

<u>EVENTS</u>	<u>ELAPSED TIME DEFINITION</u>
(R-06)-(R-03)	Elapsed SACC processing time from receipt of TAR to selection of aircraft.
(R-07)-(R-06)	Elapsed SACC processing time from selection of aircraft to first attempt to transmit launch order (ground/deck alert).
(R-09)-(R-06)	Elapsed SACC processing time from selection of aircraft to first attempt to communicate with flight leader (air alert/divert).
(R-07)-(R-03)	TACC/SACC total processing time (ground/deck alert).
(R-09)-(R-03)	TACC/SACC total processing time (air alert/divert).

TABLE E-15

ELAPSED TIMES: REQUEST PHASE COMMUNICATION TIMES (CONTROL AFLOAT)

<u>EVENTS</u>	<u>ELAPSED TIME DEFINITION</u>
(R-03)-(R-02)	Either FAC(G), FAC(A), TAC(A) or ALO to SACC transmission time.
(R-08)-(R-07)	TACC to launch site communication time.
(E-01)-(R-07)	TACC to flight leader communication time (ground/deck alert).
(E-02)-(R-09)	TACC to flight leader communication time (air alert/divert).

TABLE E-16

ELAPSED TIMES: REQUEST PHASE LINK TIMES (CONTROL AFLOAT)

<u>EVENTS</u>	<u>ELAPSED TIME DEFINITION</u>
(R-03) - (R-02)	Either FAC(G), FAC(A), TAC(A) or ALO to SACC link time.
(E-01) - (R-03)	TACC/SACC to ground/deck alert link time.
(E-02) - (R-03)	TACC/SACC to air alert/divert link time.
(E-01) - (R-02)	Elapsed time for the Request Phase.
or (E-02) - (R-02)	

Request Phase
Elapsed Time

FAC to TACC/SACC
Link Time

TACC/SACC to Alert Posture
Link Time

FAC to SACC
Transmission
Time

TACC/SACC
Processing
Time

TACC to Flight Leader
Communication
Time

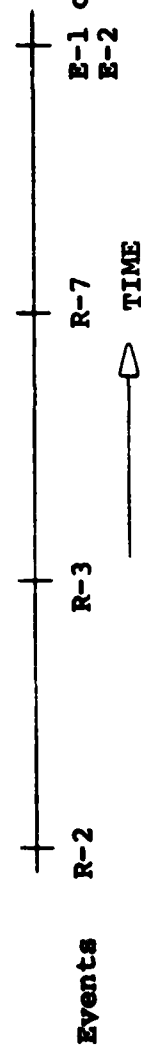


FIGURE E-10 ELAPSED TIME: REQ 3ST PHASE (CONTROL AFLOAT)

TABLE E-17

CRITICAL EVENT NUMBER VERSUS FORM/QUESTION NUMBER - NAVY/MARINE
CORPS REQUEST PHASE (CONTROL AFLOAT)

<u>CRITICAL EVENT NO.</u>	<u>FORM - QUESTION NO.</u>	<u>CRITICAL EVENT NO.</u>	<u>FORM - QUESTION NO.</u>
R-1	1-7a, 8-6a	R-8	5-5, 11-5b
R-2	1-7b, 8-6b	R-9	11-7b
R-3	1-10, 8-6d, 10-4b	R-10	2-76
R-4	10-7a	R-11	2-12
R-5	10-10a	R-12	2-4, 10-6
R-6	10-12c	R-13	10-8
R-7	11-5a	R-14	10-13a, 11-12c



(R-12). For ground alert aircraft, the mission would be transmitted to a launch site (R-14). In the case of air alert or diverted aircraft, the order may be related through the TAOC (R-13), or transmitted directly to the flight leader (E-2).

(5) FSCC monitor functions are indicated by the events R-15, R-16, and R-17.

(6) In the event that an assigned mission is aborted (R-18, R-19) and the request is not cancelled, either the DASC or the TACC would select another flight of aircraft to fill the request.

i. Event Definitions (Control Ashore). For purposes of data collection, the events shown in Figure E-11 are defined in Table E-18.

j. Elapsed Times Between Critical Events (Control Ashore). The elapsed times for the Request Phase are defined in Tables E-19, E-20 and E-21. The principal elapsed times for DASC and TACC controlled aircraft are illustrated in Figures E-12 and E-13.

k. Events and Data Form Questions (Control Ashore). The relationships between the events illustrated in Figure E-11 and the data form questions are given in Table E-22.

TABLE E-18

REQUEST PHASE EVENT DEFINITIONS: NAVY/MARINE CORPS COMMAND
AND CONTROL NETWORK FOR CAS (CONTROL ASHORE)

<u>EVENTS</u>	<u>DEFINITIONS</u>
R-01	The time at which the FAC(G), FAC(A), TAC(A), or ALO first attempts to transmit.
R-02	The time at which the FAC(G), FAC(A), TAC(A), or ALO begins transmission of the TAR.
R-03	The time at which the DASC acknowledges receipt of the TAR (after readback).
R-04	The availability of DASC controlled aircraft (available or not available) at the time of selection of aircraft to satisfy the TAR.
R-05	The time at which DASC controlled aircraft are selected to satisfy the TAR.
R-06	The time at which the DASC first attempts to transmit the launch order or execution order to the launch site or flight leader.
R-07	The time at which receipt of the launch order is acknowledged at the launch site (after readback).
R-08	The time at which instructions are issued to hold the TAR until control DASC controlled aircraft are available.
R-09	The time at which the DASC first attempts to transmit the TAR to the TACC.
R-10	The time at which receipt of the TAR is acknowledged at the TACC (after readback).
R-11	The time at which TACC controlled aircraft are selected to satisfy the TAR.
R-12	The time at which the TACC first attempts to transmit the launch order or execution order to the launch site, flight leader or TAOC.
R-13	The time at which the TAOC acknowledges receipt of CAS order.
R-14	The time at which receipt of the launch order is acknowledged at the launch site.
R-15	The time at which the FSCC's completed monitoring a TAR.
R-16	The time at which fire support coordination is completed and the TAR is cleared.
R-17	The times at which CAS agencies acknowledge notification of disapproval of a TAR.
R-18	The time at which the DASC acknowledges notification that a flight aborted its mission.
R-19	The time at which the TACC acknowledges notification that a flight aborted its mission.

TABLE E-19

ELAPSED TIMES: REQUEST PHASE PROCESSING TIMES (CONTROL ASHORE)

EVENTS

ELAPSED TIME DEFINITION

(R-05)-(R-03)	Elapsed DASC processing time from receipt of TAR to selection of aircraft.
(R-06)-(R-05)	Elapsed DASC processing from selection of aircraft to first attempt to transmit CAS order.
(R-06)-(R-03)	Total DASC processing time for DASC controlled aircraft.
(R-09)-(R-03)	DASC processing time for TAR's sent to the TACC.
(R-11)-(R-10)	Elapsed TACC processing time from receipt of TAR to selection of aircraft.
(R-12)-(R-11)	Elapsed TACC processing time from selection of aircraft to first attempt to transmit.
(R-12)-(R-10)	Total TACC processing time.

TABLE E-20

ELAPSED TIMES: REQUEST PHASE COMMUNICATION TIMES (CONTROL ASHORE)

<u>EVENTS</u>	<u>ELAPSED TIME DEFINITION</u>
(R-03)-(R-02)	FAC to DASC transmission time.
(R-07)-(R-06)	DASC to launch site communication time.
(E-02)-(R-06)	DASC to flight leader communication time.
(E-01)-(R-07)	Launch site to flight leader communication time.
(R-10)-(R-09)	DASC to TACC communications time.
(R-13)-(R-12)	TACC to TAOC communications time.
(R-14)-(R-12)	TACC to launch site communications time.
(E-02)-(R-12)	TACC to flight leader communications time.
(E-01)-(R-14)	Launch site to flight leader communications time.
(E-02)-(R-13)	TAOC to flight leader communications time.

TABLE E-21

ELAPSED TIMES: REQUEST PHASE LINK TIMES (CONTROL ASHORE)

<u>EVENTS</u>	<u>ELAPSED TIME DEFINITION</u>
(R-03)-(R-02)	FAC to DASC link time.
(E-02)- or - (E-01)-(R-03)	DASC to alert posture link times.
(R-10)-(R-07)	DASC to TACC link time.
(R-13)-(R-10)	TACC to TAOC link time.
(E-02) - or - (E-01)-(R-12)	TACC to alert posture link time.
(E-01)-(R-13)	TAOC to alert posture link time.

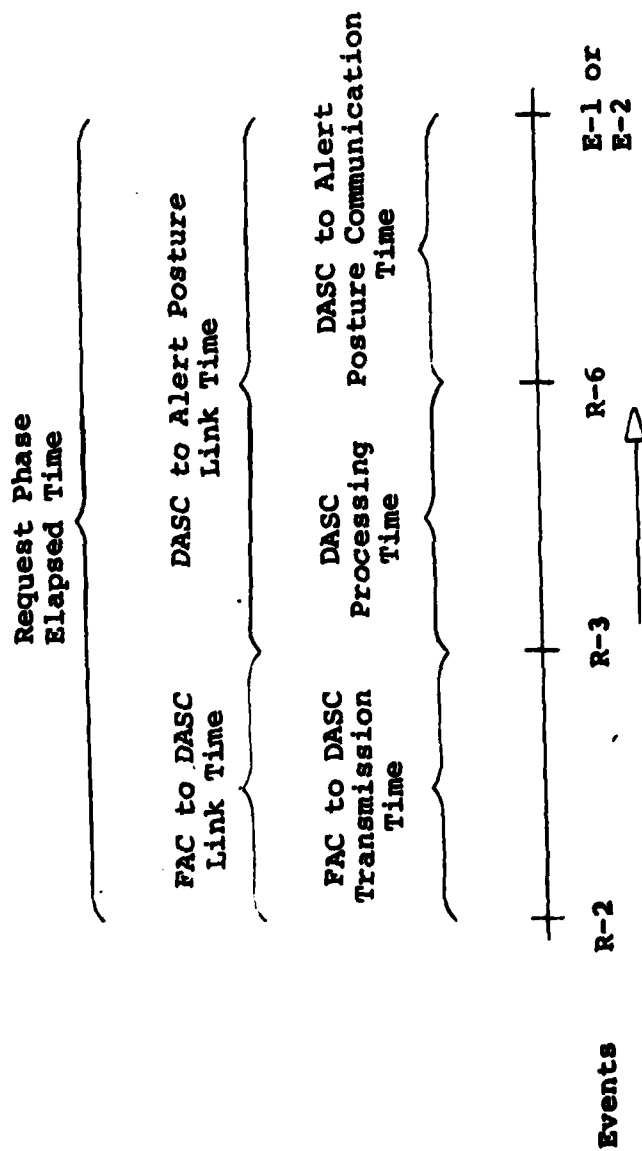


Figure E-12. Elapsed Time: Request Phase for DASC Controlled Aircraft (Control Ashore)

Request Phase
Elapsed Time

FAC to DASC
Link Time

DASC to TACC
Link Time

TACC to Alert
Posture Link Time

FAC Processing Time
FAC to DASC Commo Time
DASC Processing Time
DASC to TACC Commo Time
TACC Processing Time
TACC to Alert Posture Commo Time

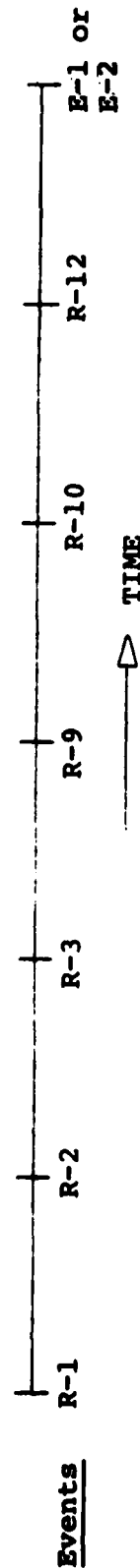


FIGURE E-13 ELAPSED TIME: REQUEST PHASE FOR TACC CONTROLLED AIRCRAFT (CONTROL ASHORE)

TABLE E-22

CRITICAL EVENT NUMBER VERSUS FORM/QUESTION NUMBER - NAVY/MARINE
CORPS REQUEST PHASE (CONTROL ASHORE)

<u>CRITICAL EVENT NO.</u>	<u>FORM - QUESTION NO.</u>	<u>CRITICAL EVENT NO.</u>	<u>FORM - QUESTION NO.</u>
R-1	1-7d, 8-6d	R-10	3-12d, 4-5
R-2	1-7b, 8-6b	R-11	4-7a
R-3	1-10, 3-6, 8-6d	R-12	4-9a
R-4	3-9a	R-13	4-9c, 6-3b
R-5	3-10b	R-14	4-9c, 5-5
R-6	3-10d	R-15	2-7b
R-7	3-10f, 5-5	R-16	2-12
R-8	DELAY ONLY	R-17	2-14, 3-7
R-9	3-12b		

5. EXECUTION PHASE.

a. General.

(1) This section describes the sequence of events in the Execution Phase of an immediate CAS mission, defines each event for purposes of data collection, and identifies elapsed times for use in the analysis of immediate CAS missions.

(2) The Execution Phase of an immediate CAS mission commences when an execution order is received by a flight leader and terminates in the target area upon completion of target attack. The Execution Phase includes the command and control functions of en route and terminal control, including communications. In addition, the Execution Phase includes the command and control functions required to reassign an execution order to fill a CAS request in the event that the flight originally assigned the order had to abort the mission.

b. Sequence of Events: Execution Phase.

(1) A comparison of the three Command and Control networks for CAS indicates the Execution Phases are similar enough to be described by a single sequence of events as shown in Figure E-14. The primary path for the Execution Phase is the sequence of events E-1 through E-14 indicated by the bold connecting lines. Deviations from the primary path are indicated by the thin connecting lines.

(2) The sequence begins with the acknowledgement of either a launch order by the flight leader for the case of ground alert (E-1) or acknowledgement of receipt of an execution order for the case of air alert or diverted flights (E-2). The sequence terminates in the target area when the flight is released by the terminal controller (E-10). After release by the terminal controller and prior to return to base (E-13) or air alert posture (E-14), the flight may be assigned a new CAS mission (E-12), depending upon remaining fuel and ordnance. For this case, the Execution Phase begins when the flight leader acknowledges receipt of a new CAS mission (E-12) followed by the sequence of events (E-4) through (E-10), inclusive.

(3) Deviations from the primary path may occur because of inability to perform required command and control functions. If the flight leader cannot establish communication with the en route controller or the terminal controller (E-4, E-5) using the primary means of communication, an alternate means may be employed (E-14, E-15). If alternate communications cannot be established with the terminal controller (E-16), the flight leader may attempt to establish communication with an alternate terminal controller, when authorized (E-17). If the flight leader cannot establish alternate communications with the en route controller (E-15) or cannot establish communications with an alternate terminal controller (E-17), the mission may be aborted (E-18). In the event the mission is aborted (E-18), the flight leader would attempt to establish communications with a mission control agency, (E-18) or (E-21). Non communications-associated command and control or aircraft malfunctions which result in a mission abort could occur at any point in time (E-20).

(4) If the target/reference point cannot be established (E-7) or the flight is not cleared for attack (E-8), then the flight may have to hold (E-22) and subsequently establish or re-establish the target/reference point (E-7). If the flight leader cannot hold, he may establish communication with an alternate controller, when authorized (E-17). If communications cannot be established with an alternate terminal controller, the flight leader may abort the mission.

(5) In the event that a CAS mission is aborted (E-18) and communication is established with a mission control agency, (E-19) or (E-21), the flight leader may receive a new mission (E-12) if the malfunction is not aircraft-associated. If the malfunction is aircraft-associated, then the mission control agency may assign the mission to a new flight, if the CAS request has not been cancelled.

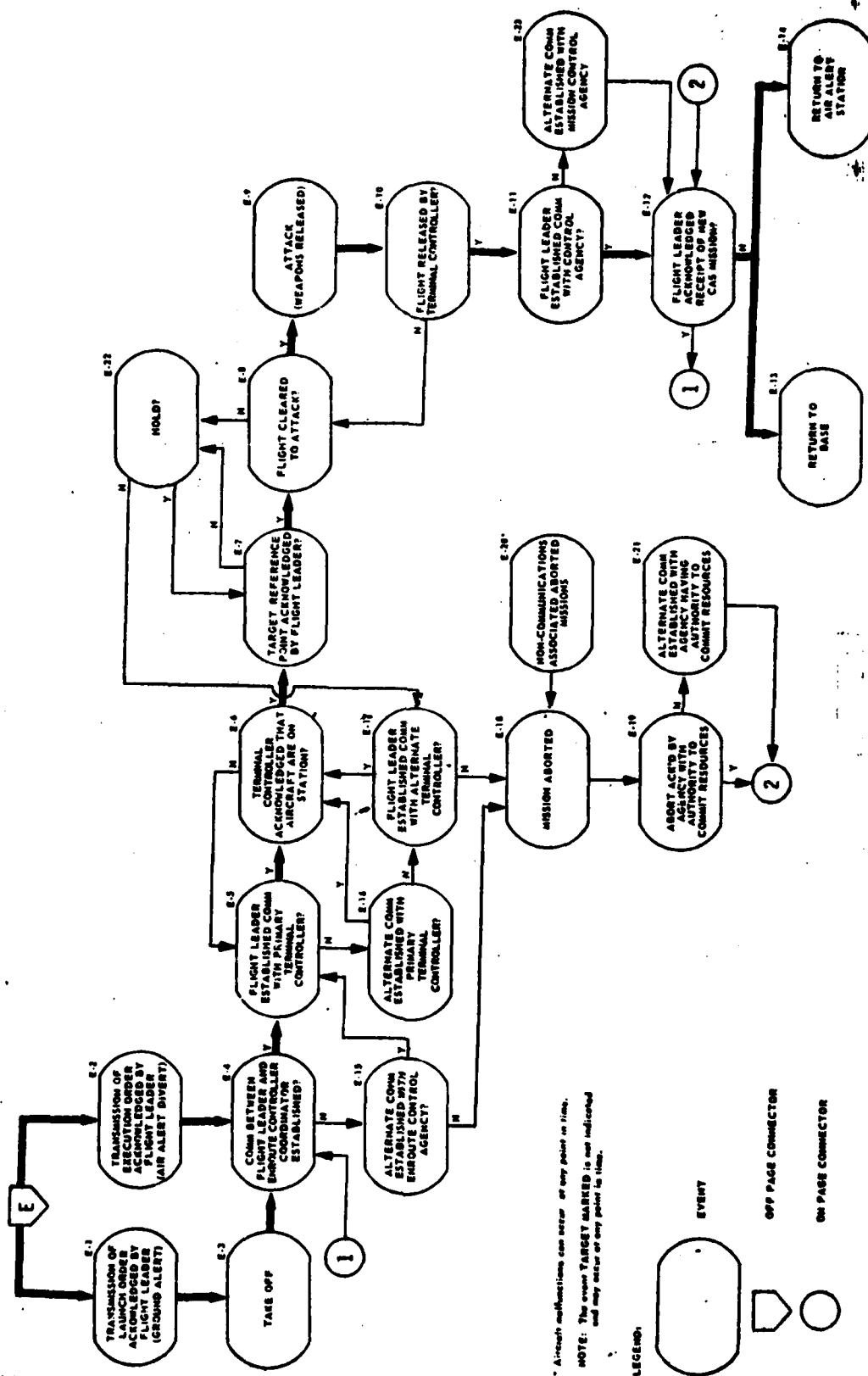


TABLE E-23

DEFINITION OF EVENTS: EXECUTION

<u>EVENT NUMBER</u>	<u>DEFINITION</u>
E-1	The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order.
E-2	The time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission.
E-3	The time at which the lead aircraft leaves the surface of the ground or the deck of an aircraft carrier.
E-4	The time at which communication is established between flight leader and en route control agency/coordinator.
E-5	The time at which communication is established between the primary terminal controller and the flight leader.
E-6	The time at which voice communication has been established between the FAC/controller and the flight leader and the FAC/controller has the aircraft in sight. (Visually controlled missions.)
E-6	The time at which voice communication has been established between the FAC and the flight leader and the leader transmits "Roger your ident." (RABFAC controlled missions.)
E-6	The time at which voice communication has been established between the ASRT controller and the flight leader and the aircraft is 20,000 meters from the target for the first time.
E-7	The time at which the FAC acknowledges a report that the flight leader has sighted the target mark or reference point.
E-8	The time at which the flight cleared to attack. (FAC/controller missions).
E-8	The time at which the flight leader acknowledges the instructions to "GO ARMSTRONG." (ASRT controlled missions)
E-9	The time at which the flight leader reports first weapons release.
E-10	The time at which the flight leader acknowledges release by the terminal controller to report to another control agency.
E-11	The occurrence of the event that the flight leader has reported to the next en route control/coordination agency and has received an acknowledgement from the controller.
E-12	The time at which the flight leader acknowledges instructions assigning him a new CAS mission.
E-13	The occurrence of the event that the flight leader acknowledges instructions to return to base.

Table E-23 (Concluded)

<u>EVENT NUMBERS</u>	<u>NODE TO NODE</u>	<u>DESCRIPTION</u>
E-14		The occurrence of the event that the flight leader acknowledges instructions to go to air alert status.
E-15		The time at which alternate communication is established between an en route control agency/coordinator.
E-16		The time at which alternate communication is established between the primary terminal controller and flight leader.
E-17		The time at which communication is established between the alternate terminal controller and flight leader.
E-18		The time at which the flight leader acknowledges receipt of a message from a control agency that the mission cannot be completed, or the time at which a controller/coordinator acknowledges receipt of a message from the flight leader that the mission cannot be completed.
E-19		The time at which the flight leader has reported to the next control agency that the mission has been aborted.
E-20		The time at which a non-communications-associated aircraft malfunction occurs which results in a mission abort.
E-21		The time at which the flight leader, using alternate communication means, has reported to the next control agency that the mission has been aborted.
E-22		The occurrence of the event that the flight leader acknowledges instruction to hold (location will be given by the controller).
E-23		The occurrence of the event that the flight leader has reported to the next en route control/coordination agency, using alternate communications, and has received an acknowledgement from the controller.

c. Execution Phase Event Definitions. The definitions of events identified in Figure E-14 are defined in Table E-23.

d. Execution Phase: Elapsed Times.

(1) The elapsed times of interest for purposes of analysis of the Execution Phase of a CAS mission are defined as illustrated in Figure E-15. The time scale identifies seven basic increments of time starting with "Delay Time Due to Mission Abort" and ending with "Target Attack Time". In addition, six other aggregated elapsed times required for analysis are identified.

(2) In the event that a flight assigned a CAS mission is aborted (E-18), and another flight is assigned the same mission, then the Total Mission Abort Delay Time is given by the difference between the times of the events (E-1)₂, (E-2)₂, or (E-12)₂, and (E-1)₁, (E-2)₁ or (E-12)₁. The subscript 1 denotes the first flight assigned a mission and the subscript 2 denotes the second flight assigned the same mission. This elapsed time would, of course, be zero if the first flight assigned the mission does not abort.

(3) An important measure in assessing the performance of the command and control systems in the command and control Abort Reaction Time. This elapsed time is a measure of the capability of the command and control networks for CAS to satisfy a CAS request in the event that a flight must abort its mission.

(4) The Execution Phase includes two link times which are Alert Posture to Terminal Controller Link Time and Terminal Controller to Target Link Time. These elapsed times are defined as illustrated in Figure E-16. It should be noted that the Terminal Controller to Target Link Time does not include Target Reattack Time, because this time is not included in estimates of the Terminal Controller to Target Link Time in the JSTF Study Phase II.

(5) The Total Terminal Control Time is the difference between the times of the events (E-10) and (E-6). Finally, the Execution Phase Elapsed Time is defined as illustrated.

e. Events and Data Form Questions. The definitions of the critical events given in previous sections were used to formulate data form questions for the three Service Execution Phases. Tables E-24 through E-27 identify the critical events and the associated data form number and question number.

6. CAS MISSION VARIABLES. In addition to the times of occurrence of events defined in previous sections, conditions that may effect times of occurrence will be recorded during the conduct of an immediate CAS mission. These conditions are referred to as Mission Variables and are listed in Table E-28.

Execution Phase
Elapsed Time

Terminal
Controller to Target
Link Time

Alert Posture to Terminal
Controller Link Time

Total Mission
Abort Delay Time

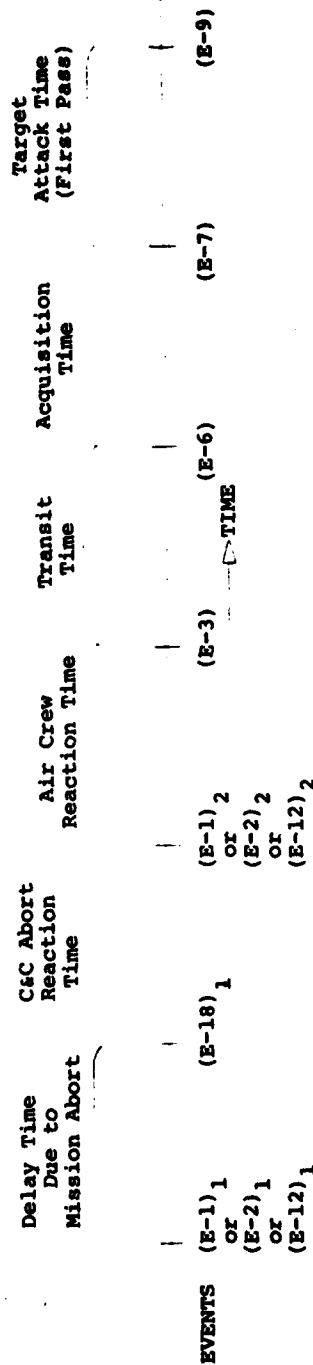


Figure E-15. Elapsed Times: Execution Phase

Table E-24

**ARMY/AIR FORCE COMMAND AND CONTROL NETWORK FOR CLOSE AIR SUPPORT
CRITICAL EVENT NO.'S VS. FORM/QUESTION NO.(S)
EXECUTION PHASE**

Critical Event No.	Form - Question No(s)	Critical Event No.	Form - Question No(s)
E-1	5-11	E-13	9-29, 6-24, 8-18
E-2	2-11, 3-13, 5-11, 6-12, 8-21	E-14	9-29, 6-24, 8-18
E-3	5-14	E-15	8-23 9-31
E-4	6-12, 6-15	E-16	9-31
E-5	9-11	E-17	9-11, 10-22 *
E-6	9-12, 8-12	E-18	3-6, 4-17, 2-13
E-7	8-12, 9-15		6-16, 8-19, 9-24
E-8	8-13, 9-17	E-19	4-18, 7-14
E-9	8-16, 9-19	E-20	5-16
E-10	8-18, 9-29	E-21	4-22, 7-15
E-11	6-23	E-22	9-18
E-12	8-21, 9-30, 6-24	E-23	4-22, 6-25, 7-15

* Shows Alternate Terminal Controller Used.

TABLE E-25

**ARMY COMMAND AND CONTROL NETWORK FOR
ATTACK HELICOPTER CLOSE AIR SUPPORT
CRITICAL EVENT NO.'S VS. FORM QUESTION NO.(S)
EXECUTION PHASE**

Critical Event No.	Form - Question No(s)
E-1	1-15, 2-15, 3-15, 4-15, 5-15, 6-15, 7-18, 8-18 9-18, 10-18, 11-18, 12-18
E-2	1-15, 2-15, 3-15, 4-15, 5-15, 6-15, 7-18, 8-18 9-18, 10-18, 11-18, 12-18
E-3	7-20, 8-20, 9-20, 10-20, 11-20, 12-20
E-4	13-7
E-5	14-11
E-6	14-14
E-7	14-16
E-8	14-18
E-9	14-20
E-10	14-29
E-11	13-15
E-12	14-30
E-13	14-29
E-14	14-29
E-15	13-7
E-16	14-31
E-17	14-12
E-18	14-17
E-19	14-25
E-20	14-25
E-21	14-25
E-22	14-17, 14-19, 14-21
E-23	13-15, 14-31

TABLE E-26

CRITICAL EVENT NO. VS. FORM/QUESTION NO: EXECUTION PHASENAVY/MARINE CORPS NETWORK (CONTROL AFLOAT)

<u>EVENT NO.</u>	<u>FORM/QUESTION NO.</u>	<u>EVENT NO.</u>	<u>FORM/QUESTION NO.</u>
E-1	5-8	E-13	11-15
E-2	11-7C	E-14	11-15
E-3	5-11	E-15	9-18
E-4	11-7a	E-16	9-18
E-5	1-18, 7-9a, 8-11	E-17	9-18
E-6	1-19, 7-13a, 8-12	E-18	9-18
E-7	1-22, 8-14	E-19	11-12
E-8	1-24, 8-14a	E-20	9-18
E-9	1-25a, 7-13b	E-21	9-18
E-10	1-2b, 7-13c, 8-14c	E-22	9-18
E-11	11-14	E-23	9-18
E-12	11-15	E-24	9-18

TABLE E-27

CRITICAL EVENT NO. VS. FORM/QUESTION NO: EXECUTION PHASENAVY/MARINE CORPS COMMAND AND CONTROL NETWORK FOR CAS

<u>EVENT NO.</u>	<u>FORM/QUESTION NO.</u>	<u>EVENT NO.</u>	<u>FORM/QUESTION NO.</u>
E-1	5-8	E-13	3-20, 4-15, 6-10, 9-17
E-2	3-10f, 4-9c, 6-3f	E-14	3-20, 4-15, 6-10, 9-17
E-3	5-11	E-15	9-18
E-4	3-16, 4-12, 6-5	E-16	9-18
E-5	1-18, 7-9a, 8-11	E-17	9-18
E-6	1-19, 7-13a, 8-12	E-18	9-18
E-7	1-22, 8-14	E-19	9-18
E-8	1-24, 8-14a	E-20	9-18
E-9	1-25a, 7-13b, 8-14b	E-21	9-18
E-10	1-25b, 7-13c, 8-14c	E-22	9-18
E-11	3-20, 4-15, 6-10	E-23	9-18
E-12	3-20, 4-15, 6-10, 9-17		

TABLE E-28

CAS MISSION VARIABLES

Aircraft <ul style="list-style-type: none">- Number- Type	Target Description <ul style="list-style-type: none">- Personnel (Open)- Personnel (Cover)- Wheeled Vehicles- Armored Vehicles/Tanks- Hardened Structures
Type of Ordnance Drop <ul style="list-style-type: none">- Live- Simulated	Type Terminal Control <ul style="list-style-type: none">- FAC (A)/Controller- FAC (G)/Controller- RABFAC- ASRT- TAC (A)
Ordnance <ul style="list-style-type: none">- Assigned- On Board	Mission of Supported Unit <ul style="list-style-type: none">- Offense- Defense- Retrograde
Alert Posture <ul style="list-style-type: none">- Ground Alert- Air Alert- Divert- RTB Divert- Ground Alert Forward	Terrain <ul style="list-style-type: none">- Open- Cluttered
Alert Status <ul style="list-style-type: none">- 05 Minutes- 10 Minutes- Other	Target Mark <ul style="list-style-type: none">- Smoke- Laser- Visual- Panels- Other
Weather <ul style="list-style-type: none">- At Launch Site (Ceiling/Vis)- At Target (Ceiling/Vis)	
Total Number of Aircraft Passes/Mission	

ANNEX F

DETAILED ANALYSIS METHODOLOGY

1. General.

a. The purpose of this annex is to provide a detailed analysis methodology for addressing ten of the eleven CAS validation objectives. One of these objectives, number five, is a Service responsibility. The objectives are complex and require some form of logical subdivision. In analyzing the ten objectives it became apparent that some measures of effectiveness were common in addressing all of the objectives. These measures were identified separately and then selectively applied to the various CAS Validation Objectives. The methodology for analyzing the measures of effectiveness and the ten objectives is the same.

b. The methodology overview is outlined graphically in Figure F-1. Sub-task I is the development of a dendritic diagram for each measure of analysis and CAS validation objective. A dendritic diagram is often referred to as a logic tree or a pattern of analysis. It is the detailed refinement of the measures of analysis and CAS validation objectives into subelements which identify the type of information required, data elements, to address the particular measure/objective. These data elements were the basis for developing the data form questionnaires (Annex C) for the three command and control networks for CAS. Through collection efforts during the scheduled Training Exercises, a data base of immediate CAS requests containing quantifiable data and qualifiable data will be gathered. After each exercise the data will be assembled into CAS request histories. Sub Task II identifies the methodology to combine and analyze the field collected data to arrive at an assessment of the stated CAS validation objective. This process is referred to as the Analysis Methodology. It is the reverse process of the dendritic diagram. The steps required to address the lowest element in the dendritic diagram will be addressed first and through the procedures to combine these steps into the next level. This is repeated until the measure/objective can be addressed.

c. In this annex, each of the sub tasks will be covered in detail. For ease in reading the dendritic diagrams and associated evaluation methodology have been included in the following appendices:

Appendix 1. CAS Validation Objectives and Measures of Analysis Dendritic Diagrams.

Appendix 2. Measures of Analysis Methodology.

2. Discussion.

a. Within each of the CAS Validation Objectives a number of measures of analysis are common. Included in these measures is a system of classification; identification of total and incremental elapsed time; a frequency analysis of delays, disapprovals and cancellations; and a distribution and analysis of the cause of delays, disapprovals and cancellations. A dendritic diagram for each measure is presented in Table F-1-1, Appendix 1. A Dewey Decimal System was used to identify the logic flow structure. The dendritic diagram (Table F-1-1) identifies the various data elements required to arrive at the various measures.

b. A dendritic diagram was developed for each objective. Each objective was subdivided into as many subobjectives required to provide the required detail. In Objective 1 there were six subobjectives identified. Each of these subobjectives were further subdivided into sub-elements. A tabular presentation similar to the measures was chosen to present the analysis procedure.

c. The analysis methodology is presented in Appendix 2. The methodology has been structured in a tabular form for ease of reference. Included is the

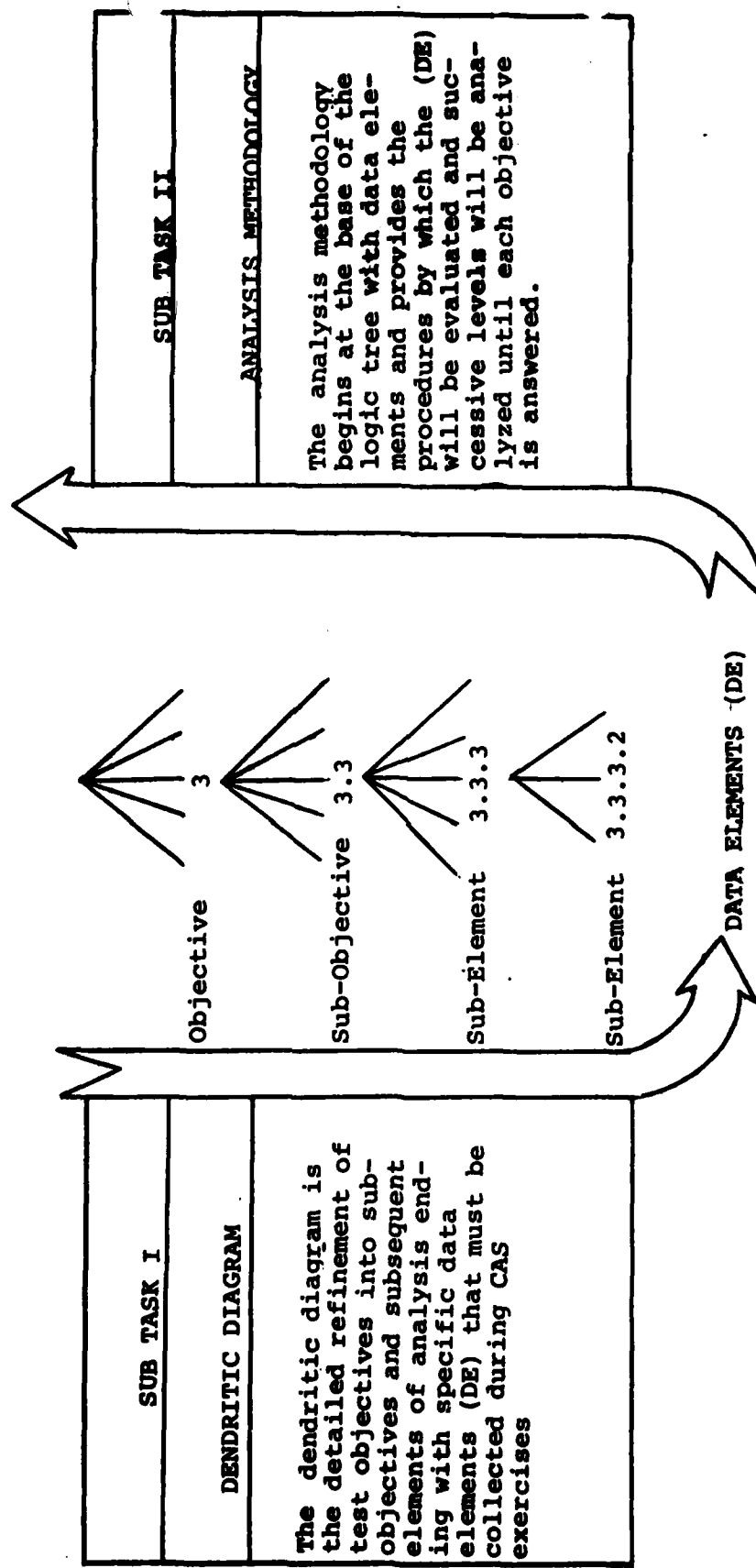


Figure F-1 Relationship Between the Dendritic Diagram/Analysis Methodology.

reference number from the dendritic tree, a description of the procedure to follow and a sample display if the procedure calls for some results. It should be noted that the outlined methodology and typical displays are based on the availability of the data and variances in the data base. Upon receipt of actual data, the methodology and displays may have to be adjusted to address the measure of analysis.

APPENDIX 1
CAS VALIDATION OBJECTIVES AND
MEASURES OF ANALYSIS DENDRITIC DIAGRAM
TO
ANNEX F
DETAILED ANALYSIS METHODOLOGY

APPENDIX I

CAS VALIDATION OBJECTIVES AND MEASURES OF ANALYSIS DENDRITIC DIAGRAM

1. Within the CAS Validation Program there are a number of measures of effectiveness which are common throughout the evaluation. These have been separated from those directly associated with a specific objective, which will be addressed in a subsequent appendix. The test conditions are: Classification by base case conditions, deviations from base case conditions, mission variables and specific paths through each command and control network for CAS; elapsed times; frequency of delays, aborts, cancellations and disapprovals; and distribution of the causes of the delays, aborts, cancellations and disapprovals. A dendritic diagram has been developed for each of the measures identified above. This diagram reduces each measure down to the specific data element required to address that measure. Figure F-I-1 presents the dendritic diagram for the measures of analysis.
2. A dendritic diagram was developed for each one of the ten CAS Validation Objectives. These are presented in Figure F-I-2 thru F-I-11. These diagrams are subdivided down to the identification of the measures of analysis.

TABLE I-I-1 BASIC MEASURES FOR ANALYSIS

1	Classification of immediate close air support requests for evaluation.	1.1	What requests were conducted under Base Case conditions?	1.1.1	What completed requests were conducted under Base Case conditions?	1.1.1.1	What completed requests were conducted during daylight hours?
						1.1.1.2	What completed requests were conducted during good weather/visibility?
						1.1.1.3	What completed requests were conducted with no damage to C&C elements.
						1.1.1.4	What completed requests were conducted without secure voice?
						1.1.1.5	What completed requests were conducted with standard equipment?
						1.1.1.6	What completed requests were conducted with a limited air threat?
						1.1.1.7	What completed requests were conducted with a limited air defense threat?
						1.1.1.8	What completed requests were conducted in a poor target environment?
						1.1.1.9	What completed requests were conducted in a non-ECM environment?
		1.1.2	What incomplete requests were conducted under Base Case conditions?	1.1.2.1	What incomplete requests were conducted during daylight hours?	1.1.2.2	What incomplete requests were conducted during good weather/visibility?
						1.1.2.3	What incomplete requests were conducted with no damage to C&C elements.
						1.1.2.4	What incomplete requests were conducted without secure voice?
						1.1.2.5	What incomplete requests were conducted with standard equipment?

TABLE E-I-1 (Continued)

1.2	What requests were conducted under deviations from Base Case conditions?		
1.2.1	What requests were conducted at night?	1.1.2.6	What incomplete requests were conducted with a limited air threat?
1.2.2	What requests were conducted during reduced weather/visibility?	1.1.2.7	What incomplete requests were conducted with a limited air defense threat?
1.2.3	What requests were conducted with a damaged C&C element/or agency for CAS	1.1.2.8	What incomplete requests were conducted in a poor target environment?
		1.1.2.9	What incomplete requests were conducted in a non-ECM environment?
		1.2.1.1	What complete requests were conducted at night?
		1.2.1.2	What incomplete requests were conducted at night?
		1.2.2.1	What complete requests were conducted during reduced weather/visibility.
		1.2.2.2	What incomplete requests were conducted during reduced weather/visibility?
		1.2.3.1	What complete requests were conducted with node 1 ₁ damaged?
		1.2.3.N	What complete requests were conducted with node N damaged?
		1.2.3.N+1	What incomplete requests were conducted with node 1 ₁ damaged?
		1.2.3.N+M	What incomplete requests were conducted with node M damaged?
1.2.4	What requests were conducted with secure voice?	1.2.4.1	What complete requests were conducted with type 1 ₂ secure voice?
		1.2.4.N	What complete requests were conducted with type N secure voice?
		1.2.4.N+1	What incomplete requests were conducted with type 1 ₂ secure voice?

TABLE F-I-1 (Continued)

1.2.4.N+M	What incomplete requests were conducted with type M secure voice?
1.2.5	What requests were conducted with new/improved equipment?
1.2.5.1	What complete requests were conducted with type 1 new/improved equipment?
1.2.5.N	What complete requests were conducted with type N new/improved equipment?
1.2.5.N+1	What incomplete requests were conducted with type 1 new/improved equipment?
1.2.5.N+M	What incomplete requests were conducted with type M new/improved equipment?
1.2.6	What requests were conducted during a substantial air threat?
1.2.6.1	What complete requests were conducted during a substantial air threat?
1.2.6.2	What incomplete requests were conducted during a substantial air threat?
1.2.7	What requests were conducted during a substantial air defense threat?
1.2.7.1	What complete requests were conducted during a substantial air defense threat?
1.2.7.2	What incomplete requests were conducted during a substantial air defense threat?
1.2.8	What requests were conducted in a target rich environment?
1.2.8.1	What complete requests were conducted in a target rich environment?
1.2.8.2	What incomplete requests were conducted in a target rich environment?
1.2.9	What requests were conducted during an ECM threat?
1.2.9.1	What complete requests were conducted with type 1 ECM threat?
1.2.9.N	What complete requests were conducted with type N ECM threat?
1.2.9.N+1	What incomplete requests were conducted with type 1 ECM threat?
1.2.9.N+M	What complete requests were conducted with type M ECM threat?

TABLE F-1-1 (Continued)

1.3	What requests were conducted with mission variables?	1.3.1	What requests were conducted by aircraft type?	1.3.1.1	What complete requests were conducted by type 1 aircraft?
				1.3.1.N	What complete requests were conducted by type N aircraft?
				1.3.1.N+1	What incomplete requests were conducted by type 1 aircraft?
				1.3.1.N+M	What incomplete requests were conducted by type M aircraft?
1.3.2	What requests were conducted from ground alert?	1.3.2.1	What complete requests were conducted from ground alert?	1.3.2.2	What incomplete requests were conducted from ground alert?
1.3.3	What requests were conducted from ground alert forward?	1.3.3.1	What complete requests were conducted from ground alert forward?	1.3.3.2	What incomplete requests were conducted from ground alert forward?
1.3.4	What requests were conducted from air alert?	1.3.4.1	What complete requests were conducted from air alert?	1.3.4.2	What incomplete requests were conducted from air alert?
1.3.5	What requests were conducted from deck alert?	1.3.5.1	What complete requests were conducted from deck alert?	1.3.5.2	What incomplete requests were conducted from deck alert?
1.3.6	What requests were conducted from divert?	1.3.6.1	What complete requests were conducted from divert?	1.3.6.2	What incomplete requests were conducted from divert?
1.3.7	What requests were conducted with five minute alert status?	1.3.7.1	What complete requests were conducted with five minute alert status?		

TABLE F-I-1 (Continued)

1.3.8	What requests were conducted with fifteen minute alert status?	1.3.7.2	What incomplete requests were conducted with five minute alert status?
1.3.9	What requests were conducted with other alert status?	1.3.8.1	What complete requests were conducted with fifteen minute alert status?
1.3.10	What requests were conducted with weather at ground alert base?	1.3.8.2	What incomplete requests were conducted with fifteen minute alert status?
1.3.11	What requests were conducted with weather in target area?	1.3.9.1	What complete requests were conducted with other alert status?
1.3.12	What requests were conducted with one pass on the target?	1.3.9.2	What incomplete requests were conducted with other alert status?
1.3.13	What requests were conducted with more than one pass on the target?	1.3.10.1	What complete requests were conducted with weather at ground alert Base?
1.3.14	What requests were conducted against personnel in the open?	1.3.10.2	What incomplete requests were conducted with weather at ground alert Base?
1.3.15	What requests were conducted against personnel covered?	1.3.11.1	What complete requests were conducted with weather at target area?
1.3.16	What requests were conducted against wheeled vehicles?	1.3.11.2	What incomplete requests were conducted with weather at target area?

TABLE F-I-1 (Continued)

1.3.17	What requests were conducted against armored vehicles/tanks?	
1.3.18	What requests were conducted against hardened structures?	
1.3.19	What requests were conducted with an FAC(A) controller?	
1.3.20	What requests were conducted with an FAC(G) controller?	
1.3.21	What requests were conducted in support of an offensive operation?	1.3.21.1 What complete requests were conducted in support of an offensive operation?
		1.3.21.2 What incomplete requests were conducted in support of an offensive operation?
1.3.22	What requests were conducted in support of a defensive operation?	1.3.22.1 What complete requests were conducted in support of a defensive operation?
		1.3.22.2 What incomplete requests were conducted in support of a defensive operation?
1.3.23	What requests were conducted in support of a retrograde operation?	1.3.23.1 What complete requests were conducted in support of a retrograde operation?
		1.3.23.2 What incomplete requests were conducted in support of a retrograde operation?
1.3.24	What requests were conducted in support of a special operation?	1.3.24.1 What complete requests were conducted in support of a special operation?
		1.3.24.2 What incomplete requests were conducted in support of a special operation?

TABLE F-I-1 continued)

- 1.3.25 What requests were conducted with target in open terrain?
- 1.3.26 What requests were conducted with target in cluttered terrain?
- 1.3.27 What requests were conducted with target marked with smoke?
- 1.3.28 What requests were conducted with target identified visually?
- 1.3.29 What requests were conducted with target marked - panels?
- 1.3.30 What requests were conducted with target marked - laser?
- 1.3.31 What requests were conducted with target marked - other?
- 1.3.32 What requests were conducted with assigned ordnance?
- 1.3.33 What requests were conducted with on board ordnance?
- 1.4 What combinations of control nodes processed the request with Base Case conditions?
 - 1.4.1 What was the path of the request in the Army/Air Force Command & Control Network for CAS with Base Case conditions?
 - 1.4.1.1 What complete requests were conducted through path number 1 with Base Case conditions?
 - 1.4.1.7 What complete requests were conducted through path number 7 with Base Case conditions?
 - 1.4.1.8 What other paths did complete immediate CAS requests take in the network?

TABLE F-I-1 (Continued)

1.4.1.9	What incomplete requests were conducted through path number 1 with Base Case conditions?
1.4.1.15	What incomplete requests were conducted through path number 7 with Base Case conditions?
1.4.1.16	What other paths did incomplete immediate CAS requests take in the network?
1.4.2	What was the path of the request in the Army Command & Control network for AH CAS?
1.4.2.1	What complete requests were conducted through path number 1 with Base Case conditions?
1.4.2.6	What complete requests were conducted through path number 9 with Base Case conditions?
1.4.2.7	What other paths did complete immediate CAS requests take in the network?
1.4.2.8	What incomplete requests were conducted through path number 1 with Base Case conditions?
1.4.2.13	What incomplete requests were conducted through path number 9 with Base Case conditions?
1.4.2.14	What other paths did incomplete immediate CAS requests take in the network?
1.4.3	What was the path of the request in the Navy/Marine Corps Command & Control network for CAS (control afloat)?
1.4.3.1	What complete requests were conducted through path number 1 with Base Case conditions?

TABLE F-I-1 (Continued)

1.4.3.3	What complete requests were conducted through path number 3 with Base Case conditions?
1.4.3.4	What other paths did complete immediate CAS requests take in the network?
1.4.3.5	What incomplete requests were conducted through path number 1 with Base Case conditions?
1.4.3.7	What incomplete requests were conducted through path number 3 with Base Case conditions?
1.4.3.8	What other paths did incomplete immediate CAS requests take in the network?
1.4.4	What was the path of the request in the Navy/Marine Corps Command & Control network for CAS (control ashore)?
1.4.4.1	What complete requests were conducted through path number 1 with Base Case conditions?
1.4.4.6	What complete requests were conducted through path number 6 with Base Case conditions?
1.4.4.7	What other paths did complete immediate CAS requests take in the network?
1.4.4.8	What incomplete requests were conducted through path number 7 with Base Case conditions?
1.4.4.13	What complete requests were conducted through path number 12 with Base Case conditions?

TABLE F-I-1 (Continued)

2	Identify elapsed times within an immediate CAS request.			1.4.4.14	What other paths did incomplete immediate CAS requests take in the network?
2.1	Determine for each Request Phase node for each immediate CAS request for each classification of request within each C&C network for CAS the processing time.	2.1.1	What is processing time?	2.1.1.1	What is the time of first attempt to transmit a request to the next node?
				2.1.1.2	What is the time of acknowledgment of a request at the present node?
2.2	Determine for each immediate CAS request for each node-to-node combination for each classification of a request within each C&C network for CAS the communications time.	2.2.1	What is communications time?	2.2.1.1	What is the time of acknowledgment of a request at the next node?
				2.2.1.2	What is the time of first attempt to transmit a request to the next node?
2.3	Determine elapsed times for each immediate CAS request for each classification of request within each C&C network for CAS.	2.3.1	What is link time?	2.3.1.1	What is the time of acknowledgment of the request at the next node?
				2.3.1.2	What is the time of acknowledgment of the request at the present node?
		2.3.2	What is Request Phase elapsed time?	2.3.2.1	What is the time of acknowledgment by the delivery agent?
				2.3.2.2	What is the start time of the Request Phase?
		2.3.3	What is first pass target attack time?	2.3.3.1	What is the time at which the flight leader reports first weapons release (E-9)?

TABLE F-I-1 (Continued)

2.3.3.2	What is the time at which the flight leader acknowledges clearance to attack the designated target (FAC/controller mission) (E-7)?
2.3.4	What is the target acquisition time?
2.3.4.1	What is the time at which the flight leader acknowledges clearance to attack the designated target (FAC/controller missions) (E-7)?
2.3.4.2	What is the time at which voice communication has been established between the ASRT controller or FAC and the flight leader and the aircraft is 20,000 meters from the target for the first time (E-6)?
2.3.5	What is the transit time?
2.3.5.1	What is the time at which voice communication has been established between the ASRT controller or FAC and the flight leader and the aircraft is 20,000 meters from the target for the first time (E-6)?
2.3.5.2	What is the time at which the lead aircraft leaves the surface of the ground or the deck of an aircraft carrier (E-3)?
2.3.6	What is the air crew reaction time?
2.3.6.1	What is the time at which the lead aircraft leaves the surface of the ground or the deck of an aircraft carrier (E-3)?
2.3.6.2	What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or what is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or

TABLE F-I-1 (Continued)

2.3.7	What is the C&C abort reaction time?	What is the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12)?
2.3.7.1		What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or What is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or What is the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12)?
2.3.7.2		What is the time at which the flight leader acknowledges receipt of a message from a control agency that the mission cannot be completed, or the time at which a controller/coordinator acknowledges receipt of a message from the flight leader that the mission cannot be completed (E-18)?
2.3.8	What is the delay time due to mission abort?	What is the time at which the flight leader acknowledges receipt of a message from a control agency that the mission cannot be completed, or the time at which a controller/coordinator acknowledges receipt of a message from the flight leader that the mission cannot be completed (E-18)?
2.3.8.1		What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or
2.3.8.2		What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or

TABLE F-I-1 (Continued)

2.3.9	What is the Mission delay time? (for requests which have an abort and a tasking of a new mission)	<p>what is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or</p> <p>what is the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12)?</p>
2.3.9.1		<p>What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or</p> <p>what is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or</p> <p>what is the time at which the flight leader acknowledges instructions assigning a new CAS mission (E-12)?</p>
2.3.9.2		<p>What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or</p> <p>what is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or</p> <p>what is the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12)?</p>
2.3.10	What is the alert posture to terminal controller link time?	<p>2.3.10.1 What is the time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6)?</p>

TABLE F-I-1 (Continued)

- 2.3.10.2 What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01);
or
what is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02);
or
what is the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12)?
- 2.3.11 What is the terminal controller to target link time?
- 2.3.11.1 What is the time at which the flight leader reports first weapons release (E-9)?
- 2.3.11.2 What is the time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6)?
- 2.3.12 What is the total target attack time?
- 2.3.12.1 What is the time at which the flight leader acknowledges release by the terminal controller to report to another control agency (E-10)?
- 2.3.12.2 What is the time at which the flight leader acknowledges clearance to attack the designated target (FAC/controller missions) (E-7)?
- 2.3.13 What is the total terminal control time?
- 2.3.13.1 What is the time at which the flight leader acknowledges clearance to attack the designated target (FAC/controller missions) (E-7)?

TABLE F-I-1 (Continued)

2.3.13.2	What is the time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6)?
2.3.14	What is Execution Phase elapsed time?
2.3.14.1	What is the time at which the flight leader reports first weapons release (E-9)?
2.3.14.2	What is the time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01); or what is the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or what is the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12)?
2.3.15	What is the immediate CAS request total elapsed time?
2.3.15.1	What is the time at which the flight leader reports first weapons release (E-9)?
2.3.15.2	What is the start time of the Request Phase?

TABLE F-I-1 (Continued)

2.4	Determine the total processing time for each immediate CAS request for each path for each command and control network for CAS.				
2.5	Determine the total communication time for each immediate CAS request for each path for each command and control network for CAS.				
3.	Identify the analysis and display techniques for the quantitative data.				
3.1	Identify those classifications of categories for total CAS requests and increments thereof which may be statistically pooled to increase the confidence in the results where sample size is minimal.				
3.2	Determine the statistical parameters for the various elapsed times identified in "2" and classified by "1" above?	3.2.1	What is minimum time?		
		3.2.2	What is mean time?		
		3.2.3	What is the median time?		
		3.2.4	What is maximum time?		
		3.2.5	What is the standard deviation?		
		3.2.6	What is the confidence limits on the mean?		
3.3	What is the cumulative percentage distribution of the elapsed times in "2" classified by the scheme in "1"?				
3.4	What is the time line for the various paths for Base Case and Deviations from Base Case conditions?				

4 Determine the frequency of delays; aborts, disapprovals and cancellations as a function of the various elapse times in "2" above.

TABLE F-I-1 (Continued)

4.1	Determine the number of immediate CAS requests with no delays for each classification of request (1.1 thru 1.4 above) within each C&C network for CAS.	4.1.1	What complete immediate CAS requests had no delays?
		4.1.2	What incomplete immediate CAS requests had no delays?
4.2	Determine the number of immediate CAS requests with one delay for each classification of requests (1.1 thru 1.4 above) within each C&C network for CAS. (Note: If sample size in a classification is not sufficient for a statistical analysis aggregate one or more delays into one set, otherwise, separate data to one, two, three, and four or more. Aggregate at the level where sample size is sufficient for a statistical analysis.)	4.2.1	What complete immediate CAS requests had one delay in the request phase?
		4.2.2	What complete immediate CAS requests had one delay in the execution phase?
		4.2.3	What complete immediate CAS requests had one delay in both phases?
		4.2.4	What incomplete immediate CAS requests had one delay in the request phase?
		4.2.5	What incomplete immediate CAS requests had one delay in the execution phase?
		4.2.6	What incomplete immediate CAS requests had one delay in both phases?
4.3	Determine the number of individual CAS requests with no aborts for each classification of requests (1.1 thru 1.4 above) within each C&C network for CAS.	4.3.1	What complete immediate CAS requests had no aborts?
		4.3.2	What incomplete immediate CAS requests had no aborts?
4.4	Determine the number of immediate CAS requests with one or more aborts for each classification of request (1.1 thru 1.4 above) within each C&C network for CAS. (Note: If sample size in a classification is not sufficient for a	4.4.1	What complete immediate CAS requests had one or more aborts?
		4.4.2	What incomplete immediate CAS requests had one or more aborts?

TABLE F-I-1 (Continued)

statistical analysis aggregate one or more aborts into one set; otherwise, separate data to one, two, three and four or more. Aggregate at the level where sample size is not sufficient for a statistical analysis.)

- | | |
|---|---|
| <p>4.5 Determine the number of immediate CAS requests with no cancellations for each request (1.1 thru 1.4 above) within each C&C network for CAS.</p> <p>4.6 Determine the number of immediate CAS requests with one cancellation for each classification of request (1.1 thru 1.4 above) within each C&C network for CAS.</p> <p>4.7 Determine the cumulative distribution of the various elapse times in "2" above for each of the various classifications of delays in 4.2.</p> | <p>4.5.1 What complete immediate CAS requests had no cancellations?</p> |
| <p>5 Determine a distribution of the causes of delays, aborts, disapprovals, and cancellations.</p> <p>5.1 Determine the cause of delays by immediate CAS request with one delay for each classification of request (1.1 thru 1.4 above) within each C&C network for CAS.</p> | <p>5.1.1 What completed immediate CAS requests had type 1 delay?</p> <p>5.1.N What completed immediate CAS requests had type N delay?</p> <p>5.1.N+1 What incomplete immediate CAS requests had type 1 delay?</p> <p>5.1.N+M What incomplete immediate CAS requests had type M delay?</p> |

TABLE F-I-1 (Concluded)

- 5.4 Repeat 5.3 for immediate CAS requests with two, three, and four aborts if the number of samples are sufficient for a statistical analysis. Otherwise, conduct an analysis of the aggregate amount, the same as 3.2 where sample size is not sufficient.
- 5.5 Determine the cause of cancellations by immediate CAS request for each classification of request (1.1 thru 1.4 above) within each C&C network for CAS.
 - 5.5.1 What incomplete immediate CAS requests had type 1 cancellation?
 - 5.5.N What incomplete immediate CAS requests had type N delay?
- 5.6 Determine the distribution of causes of delays/ aborts as a function of the CAS Validation Objectives.

TABLE NO. F-I-2

DESCRIPTIC DIAGRAM FOR OBJECTIVE NO. 1

Determination of response times for immediate demands on the close air support (CAS) command and control system, including transmission, processing, and transit time.

- 1.1 Assess immediate CAS request response times for Base Case missions.
 - 1.1.1 Determine immediate CAS request response times using only Base Case completed missions.
 - 1.1.1.1 What complete immediate CAS requests are Base Case?
 - 1.1.1.2 What are the C&C network for CAS response times for the completed Base Case missions?
- 1.2 Assess communication processing and transit times for each C&C network for CAS as a function of selected conditions.
 - 1.2.1 Determine the percentage of requests filled in 15 minutes, 20 minutes, and 40 minutes.
 - 1.2.1.1 What missions were Base Case/non-Base Case?
 - 1.2.1.2 What were the communication times between nodes for the Base Case?
 - 1.2.1.3 What were the communication times between nodes for each deviation from the Base Case?
 - 1.2.1.4 What were the processing times at each node for the Base Case?
 - 1.2.1.5 What were the processing times at each node for each deviation from Base Case?
 - 1.2.1.6 What were the transit times for Base Case?
 - 1.2.1.7 What were the transit times for each deviation from Base Case?
- 1.3 Compare response times as functions of different paths through the C&C network for CAS with Phase II results for completed Base Case missions.
 - 1.3.1 Determine response times for selected Path 1 by C&C network for CAS.

TABLE NO. F-I-2 (Continued)

- 1.3.N Determine response times for selected Path N by CnC network for CAS. (N is the "n"th path selected for analysis).
- 1.4 Assess system/node response times for deviation from the Base Case and other selected variables.
 - 1.4.1 Determine the response times for deviations from Base Case.
 - 1.4.2 Determine the response times during an offensive operation.
 - 1.4.3 Determine the response times during defensive operations.
 - 1.4.4 Determine the response times during retrograde operations.
 - 1.4.5 Determine the response times for ground alert.
 - 1.4.6 Determine the response times for air alert.
 - 1.4.7 Determine the response times for divert.
- 1.5 Assess the effects of delays on the response times for completed missions.
 - 1.5.1 Determine the frequency of delays during the request phase, execution phase, and both the request and execution phase.
 - 1.5.2 Assess the distribution of causes of delay.
 - 1.5.3 Assess the distribution of causes of delay as a function of the CAS validation objectives.
- 1.6 For incomplete missions, and completed missions with aborts, compare the frequency and causes of aborts and cancellations.
 - 1.6.1 Determine the frequency and causes of aborts and cancellations of Base Case missions.
 - 1.6.2 Determine the frequency and causes of aborts and cancellations of deviations from Base Case.
 - 1.6.3 Determine the distribution and cause of aborts and cancellations as a function of the tactical situation.

TABLE NO. F-I-2 (Concluded)

1.6.4 Determine the distribution and cause of aborts and cancellations as a function of the alert status.

1.6.5 Determine the distribution of the cause of aborts and cancellations as a function of the CAS validation objectives.

TABLE NO. F-I-3

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 2

Determination of communication requirements, both ground and airborne, at all levels, including secure transmission needs.

- 2.1 Assess the effect of communication difficulties on system/node response times and the success or failure to perform essential functions.
 - 2.1.1 Determine effect of communication delays on response times for completed missions.
 - 2.1.1.1 Determine a cumulative response time graph of completed communication delayed missions.
 - 2.1.1.2 Determine a cumulative response time graph of completed non-delayed missions.
 - 2.1.1.3 Determine the cause and location where communication delays occur.
 - 2.1.1.4 Determine the frequency of communication delays for system/nodes.
 - 2.1.2 Determine the number of aborts/CNX attributed to communication delays.
 - 2.1.3 Determine the impact of alternate communications on response times.
 - 2.2.1 Determine the system/node frequency of processing missions while ECM employed.
 - 2.2.2 Determine the system/node frequency of delays attributed to ECM.
 - 2.2.3 Determine the effects of ECM on response time in the system/nodes.
 - 2.2.4 Determine the system/node frequency of aborts/cancellations attributed to ECM.
- 2.2 Assess the effects of ECM on mission response times and success or failure to perform essential functions.
 - 2.1.2 Determine the number of aborts/CNX attributed to communication delays.
 - 2.1.3 Determine the impact of alternate communications on response times.
 - 2.2.1 Determine the system/node frequency of processing missions while ECM employed.
 - 2.2.2 Determine the system/node frequency of delays attributed to ECM.
 - 2.2.3 Determine the effects of ECM on response time in the system/nodes.
 - 2.2.4 Determine the system/node frequency of aborts/cancellations attributed to ECM.

TABLE NO. F-I-3 (Concluded)

- | | |
|-------|---|
| 2.3 | Assess the effects of secure communications in terms of response times and success or failure to perform essential functions. |
| 2.3.1 | Determine the frequency of processing missions with secure communications. |
| 2.3.2 | Determine the system/node frequency of delays attributed to secure communications. |
| 2.3.3 | Determine the effect of delays resulting from secure communications on response times in the system/nodes. |
| 2.3.4 | Determine the system/node frequency of aborts/cancellations attributed to secure communications. |

TABLE NO. F-I-4

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 3

Determination of the capability to integrate CAS with other tactical operations in the combat area, including the consideration of fire support coordination, air defense, and airspace control functions.

- 3.1 Compare the frequency and causes of delays and system failures attributed to integration problems.
 - 3.1.1 Determine the frequency and causes of delays and system degradation due to fire support coordination.
 - 3.1.2 Determine the frequency and causes of delays and system degradation due to Air Defense Coordination.
 - 3.1.3 Determine the frequency and causes of delays and system degradation due to Air Space Control.
- 3.2 Assess the effect of integration difficulties through system and node-to-node response times.
 - 3.2.1 Compare system and node-to-node response times for missions with fire support coordination delays with those without delays.
 - 3.2.2 Compare system and node-to-node response times for missions with air defense coordination delays with those without delays.
 - 3.2.3 Compare system and node-to-node response times for missions with Air Space Control delays with those without delays.

TABLE NO. F-I-5

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 4

Determination of maximum system capacity to handle target attacks under clear weather conditions.

- 4.1 Assess the effect of saturation on throughput/response time at each node.
 - 4.1.1 Determine the level of throughput by node.
 - 4.1.2 Determine the effect of saturation on response time at each node.
- 4.2 Assess the system capacity to handle target attacks in time of success/failures to perform essential functions.
 - 4.2.1 Determine the frequency and cause of aborts caused by system/node saturation.
 - 4.2.2 Determine the frequency and cause of cancellations caused by system/node saturation.
 - 4.2.3 Determine the number of missions which can be controlled simultaneously by the final controller.

TABLE NO. F-I-6

DENDRIFIC DIAGRAM FOR OBJECTIVE NO. 6

Determination of the degradation of the system's ability to provide effective command and control of CAS at night, in bad weather, or under artificially reduced visibility.

- 6.1 Assess frequency and response times as a function of weather/visibility/night.
 - 6.1.1 Determine the frequency of processing mission at night and in reduced weather/visibility.
 - 6.1.2 Determine the system/node frequency of delays attributed to weather/visibility.
 - 6.1.3 Determine the effect of delays resulting from reduced weather/visibility on response times in the system/nodes.
 - 6.1.4 Determine the system/node frequency of aborts/cancellations attributed to reduced weather/visibility.
- 6.2 Assess effects of reduced weather/visibility in terms of success or failure to perform essential functions.
 - 6.2.1 Identify mission aborts caused by reduced weather/visibility conditions.
 - 6.2.2 Identify mission cancellations caused by reduced weather/visibility conditions.

TABLE NO. F-I-7
DENDRITIC DIAGRAM FOR OBJECTIVE NO. 7

Determination of the ability of various CAS target acquisition systems to detect and identify hostile targets and hand off these targets to an attacking agent.

- 7.1 Assess the time to acquire the target reference point as a function of final controller/ method of acquisition/delays/ no delays.
 - 7.1.1 Determine the time to acquire the target/reference point as a function of final controller.
 - 7.1.2 Determine the time to acquire the target/reference point as a function of the method of acquisition.
 - 7.1.3 Determine the time to acquire the target reference point as a function of no delays.
 - 7.1.4 Determine the time to acquire the target reference point as a function of delays attributed to inability of the final controller to identify the target/reference point.
 - 7.1.5 Determine the time to acquire the target reference point as a function of delays attributed to inability of the delivery agent to identify the target/reference point.
- 7.2 Assess the frequency of delays caused by inability of the final controller/delivery agent to identify the target/reference point.
 - 7.2.1 Determine the frequency and cause of delays due to the inability of the final controller to identify the target/reference point.
 - 7.2.2 Determine the frequency and cause of delays due to inability of the delivery agent to identify the target/reference point.
- 7.3 Assess the frequency of aborts/ cancellations caused by the inability of the final controller/delivery agent to identify the target/reference point.
 - 7.3.1 Determine the frequency of aborts caused by the final controller's inability to identify the target/reference point.

TABLE NO. F-I-7 (Concluded)

7.3.2 Determine the frequency of aborts caused by the delivery agent's inability to identify the target/reference point.

7.3.3 Determine the frequency of cancellations caused by the final controller's inability to identify the target/reference point.

7.3.4 Determine the frequency of cancellations caused by the delivery agent's inability to identify the target/reference point.

TABLE NO. F-I-8

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 8

Determination of the extent of system degradation resulting from damage to individual elements.

- 8.1 Determine the effect of damage/destruction of C&C for CAS elements on response time.
 - 8.1.1 Determine the effects of damage to C&C for CAS elements on node-to-node and complete mission response time (isolate where possible any node-to-node combination causing significant delays).
 - 8.1.2 Determine the effect of destruction to C&C for CAS elements on total response time.
- 8.2 Determine the frequency and cause of delays due to damage or destruction of selected C&C for CAS elements.
 - 8.2.1 Determine the frequency and cause of delays due to damage to selected C&C for CAS elements.
 - 8.2.2 Determine the frequency and cause of delays due to destruction of selected C&C for CAS elements.
- 8.3 Determine the number/frequency of aborts/cancellations due to damage/destruction of selected C&C for CAS elements.
 - 8.3.1 Determine the number/frequency of aborts due to damage of selected C&C for CAS elements.
 - 8.3.2 Determine the number of aborts due to destruction of selected C&C for CAS elements.
 - 8.3.3 Determine the number of cancellations resulting from damage to selected C&C for CAS elements.
 - 8.3.4 Determine the number of cancellations resulting from destruction of selected C&C for CAS elements.

TABLE NO. F-I-9

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 9

Determination of the functioning of intelligence information and friendly data availability as aids in decision-making within the command and control system. Examine information requirements, accuracies, and times involved in entering it in the system and making decisions based on it.

- 9.1 Determine the frequency of delays and effect on response time caused by insufficient intelligence, friendly information or target information.
 - 9.1.1 Determine the frequency of delays caused by insufficient intelligence of target, friendly information or target information.
 - 9.1.2 Determine the effect on response times caused by insufficient intelligence of target, friendly information or target information.
- 9.2 Determine the number of aborts/cancellations caused by lack of intelligence information, friendly information or target information.
 - 9.2.1 What abort/cancellations were caused by insufficient intelligence information.
 - 9.2.2 What aborts/cancellations were caused by insufficient friendly information?
 - 9.2.3 What aborts/cancellations were caused by insufficient target information?

TABLE NO. F-I-10

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 10

Determination of the compatibility and interoperability of the elements of the CAS command and control system.

- 10.1 Determine the frequency of delays and effect on response time due to lack of compatibility or interoperability of the C&C network for CAS.
 - 10.1.1 Determine the frequency of delays due to lack of compatibility or interoperability of C&C network for CAS.
 - 10.1.2 Determine the effects of delays due to compatibility or interoperability of the C&C network for CAS on response time.
- 10.2 Same as all levels of 10.1, substitute Tactical Data Systems for C&C network for CAS.
- 10.3 Determine the number of missions aborted/cancelled due to lack of compatibility or interoperability.
 - 10.3.1 Determine the number of missions aborted due to compatibility or interoperability.
 - 10.3.2 Determine the number of missions cancelled due to compatibility or interoperability.

TABLE NO. F-I-11

DENDRITIC DIAGRAM FOR OBJECTIVE NO. 11

Evaluation of the improvements offered by new/improved equipments in the other test objectives.

- 11.1 Assess the effect of new, improved equipment on response time.
 - 11.1.1 What new/improved equipment was used, when and where?
 - 11.1.1.2 Determine the effect on response time using the new/improved equipment.
- 11.2 Determine the frequency of and causes of delays due to new/improved equipment.
- 11.3 Determine the number of aborts/cancellations due to new/improved equipment.
 - 11.3.1 Determine the number of aborts due to new/improved equipment.
 - 11.3.2 Determine the number of cancellations due to new/improved equipment.

APPENDIX II
MEASURES OF ANALYSIS METHODOLOGY
TO
ANNEX F
DETAILED ANALYSIS METHODOLOGY

APPENDIX II

METHODOLOGY FOR THE MEASURES OF ANALYSIS

The methodology uses the dendritic diagram developed in Annex F, Appendix I as the basic structure for analysis. The methodology begins at the base of the logic tree with data elements and provides the procedures by which the data element will be evaluated and successive levels will be analyzed until each objective is answered. Table F-II-1 presents the methodology for the measures of analysis.

TABLE F-II-1

MEASURES OF ANALYSIS METHODOLOGY

<u>LINE NO.</u>	<u>REF. NO. IN BASIC MEASURE OF EVALUATION</u>	<u>ACTION REQUIRED</u>
01		<p>The analysis methodology assumes that the data information has been sorted into mission time lines, Execution Phase, and appropriate Request Phase for the command and control network for CAS. This will include ordering the quantifiable data and a referencing scheme for identifying the appropriate qualitative data with the request/mission history.</p> <p>The methodology is based on identifying each immediate CAS request by the classification system outlined in level one of the measures of analysis. This may take the form of a separate file for each classification or a coded system where each immediate CAS mission request is identified by the appropriate classification (s).</p>
02	1.1.1.1	Identify all complete immediate CAS requests by those complete immediate CAS requests conducted during daylight, i.e., between sunrise and sunset. (A complete CAS request is one that includes weapons release whether it be the initial mission or a retask in the event of an abort.)
03	1.1.1.2	Further identify those complete immediate CAS requests in line 2 by those complete immediate CAS requests conducted during good weather/visibility. Include those missions operating under VFR at the launch site, en route and in the terminal area and where weather was near minimums at the launch site or en route but did not have an impact on the mission progress. (This information will be found from the launch site data forms and pilot data forms/debriefing forms in the remarks and delays.)
04	1.1.1.3	Further identify those complete immediate CAS requests in line 3 by those complete immediate CAS requests conducted with no command and control element for CAS damaged. In this context, damage refers to catastrophic damage and not the fuse blown or a bad mike which can be readily replaced. The data collectors' remarks will indicate any damage plus check to see that no planned damage was included in the scenario for the time period of the immediate CAS request.
05	1.1.1.4	Further identify those complete immediate CAS requests in line No. 4 by those complete immediate CAS requests conducted without secure voice.
06	1.1.1.5	Further identify those complete immediate CAS requests in line No. 5 by those complete immediate CAS requests conducted with standard equipment. Any new/improved equipment will be noted as a line item in the scenario and in the remarks by the data collectors.

TABLE F-II-1 (Continued)

07	1.1.1.6	Further identify those complete immediate CAS requests in line No. 6 by those completed immediate CAS requests conducted in a limited air threat environment. A limited air threat environment includes those cases where the air threat has minimal impact on the conduct of an immediate CAS request. It will be identified through the scenario.
08	1.1.1.7	Further identify those complete immediate CAS requests in line No. 6 by those complete immediate CAS requests conducted in a limited air defense threat environment. A limited air defense threat environment includes those cases where the air defense threat has minimal impact on the conduct of an immediate CAS request. It will be identified through the scenario.
09	1.1.1.8	Further identify those complete immediate CAS requests in line No. 8 by those complete immediate CAS requests conducted in a target poor environment. The periods of a poor target environment will be identified in the scenario.
10	1.1.1.9	Further identify those complete immediate CAS requests in line No. 9 by those complete immediate CAS requests conducted with no ECM. The periods of ECM will be identified in the scenario. A log of the ECM periods will be used to identify periods where no ECM was employed.
11	1.1.1	Those complete immediate CAS requests which sequentially meet all of the various criteria in line numbers 2 through 10 will be considered a part of the Base Case data base.
12	1.1.2.1	Identify all incomplete immediate CAS requests by those incomplete immediate CAS requests conducted during daylight, i.e., between sunrise and sunset.
13	1.1.2.2	Further identify those incomplete immediate CAS requests in line 2 by those incomplete immediate CAS requests conducted during good weather/visibility. Include those missions operating under VFR at the launch site, en route and in the terminal area and where weather was near minimums at the launch site or en route but did not have an impact on the mission progress. (This information will be found from the launch site data forms and pilot data forms/debriefing forms in the remarks and delays.)
14	1.1.2.3	Further identify those incomplete immediate CAS requests in line 3 by those incomplete immediate CAS requests conducted with no command and control element for CAS damaged. In this context, damage refers to catastrophic damage and not the fuse blown or a bad mike which can be readily replaced. The data collectors' remarks will indicate any damage plus check to see that no planned damage was included in the scenario for the time period of the immediate CAS request.
15	1.1.2.4	Further identify those incomplete immediate CAS requests in line No. 4 by those incomplete immediate CAS requests conducted without secure voice. If secure voice is planned it will be included as a line item in the scenario and annotated on the data collector forms in the remarks.

TABLE F-II-1 (Continued)

16	1.1.2.5	Further identify those incomplete immediate CAS requests in line No. 5 by those incomplete immediate CAS requests conducted with standard equipment. Any new/improved equipment will be noted as a line item in the scenario and in the remarks by the data collectors.
17	1.1.2.6	Further identify those incomplete immediate CAS requests in line No. 6 by those incomplete immediate CAS requests conducted in a limited air threat environment. A limited air threat environment includes those cases where the air threat has minimal impact on the conduct of an immediate CAS request. A check on delays is required to insure that no delays were a result of the air threat.
18	1.1.2.7	Further identify those incomplete immediate CAS requests in line No. 6 by those incomplete immediate CAS requests conducted in a limited air defense threat environment. A limited air defense threat environment includes those cases where the air defense threat has minimal impact on the conduct of an immediate CAS request. It will be identified through the scenario. A check of delays is required to insure no delays were a result of the air defense threat.
19	1.1.2.8	Further identify those incomplete immediate CAS requests in line No. 8 by those incomplete immediate CAS requests conducted in a target poor environment. The periods of a poor target environment will be identified in the scenario.
20	1.1.2.9	Further identify those incomplete immediate CAS requests in line No. 9 by those incomplete immediate CAS requests conducted with no ECM. The periods of ECM will be identified in the scenario. A log of the ECM periods will be used to identify periods where no ECM was employed. Those immediate CAS requests with delays from ECM when none was present will have to be identified and a judgment made as to the cause of the misidentified delay.
21	1.1.2	Those incomplete immediate CAS requests which sequentially meet all of the various criteria in line numbers 2 through 10 will be considered the Base Case data base.
22	1.1	The complete immediate CAS requests identified in line No. 11 and those incomplete ones identified in line No. 21 form the file of requests conducted under Base Case conditions.
23	1.2.1.1	Identify those complete immediate CAS requests conducted during the period from sundown to sunrise.
24	1.2.1.2	Identify those incomplete immediate CAS requests conducted during the period from sundown to sunrise.
25	1.2.1	Those immediate CAS requests identified in line numbers 23 and 24 form the data base for those immediate CAS requests conducted during hours of darkness.
26	1.2.2.1	Identify those complete immediate CAS requests conducted during reduced weather/visibility. A separate identifier should be used for the launch site, the transit phase and the terminal phase. Reduced weather/visibility will be identified on data collection forms.

TABLE F-II-1 (Continued)

27	1.2.2.2	Identify those incomplete immediate CAS requests conducted during reduced weather/visibility. A separate identifier should be used for the launch site, the transit phase and the terminal phase. Reduced weather/visibility will be identified through delays, flight clearance (IFR), type of terminal control (ASRT) and weather measurements.
28	1.2.2	Those immediate CAS requests identified in line numbers 26 and 27 form the data base for those immediate CAS requests conducted during reduced weather/visibility.
29	1.2.3.1	Identify those complete immediate CAS requests conducted with node 1 damaged, e.g., DASC or battalion CP. The period(s) of simulated damage will be found in the scenario with a check through the data collectors' remarks. If actual damage situation exists it will be noted in the data collectors remarks/delays.
30	1.2.3.N	Repeat line No. 29 for each separately damaged node or combinations which may occur.
31	1.2.3.N+1	Identify those incomplete immediate CAS requests conducted with node 1 damaged, e.g., DASC or battalion CP. The period(s) of simulated damage will be found in the scenario with a check through the data collectors' remarks. If actual damage situation exists it will be noted in the data collectors' remarks/delays.
32	1.2.3.N+M	Repeat line 31 for each separately damaged node or combination which may occur.
33	1.2.3	Those immediate CAS requests identified in line numbers 29 through 32 form the data base for those immediate CAS requests conducted during periods of damaged command and control elements/agencies for CAS.
34	1.2.4.1	Identify those complete immediate CAS requests conducted with type 1 secure voice. The period(s) when this type secure voice will be employed will be identified in the scenario and confirmed in the data collectors' remarks/delays.
35	1.2.4.N	Repeat line No. 34 for each type of secure voice employed, also identify separately any combinations of types of secure voice.
36	1.2.4.N+1	Identify those incomplete immediate CAS requests conducted with type 1 secure voice. The period(s) when this type secure voice will be employed will be identified in the scenario and confirmed in the data collectors' remarks/delays.
37	1.2.4.N+M	Repeat line No. 36 for each type of secure voice employed, also identify separately any combinations of types of secure voice.
38	1.2.4	Those immediate CAS requests identified in line numbers 34 through 37 form the data base for those immediate CAS requests conducted with secure voice.
39	1.2.5.1	Identify those complete immediate CAS request conducted with type 1 new/improved equipment. The period(s) when this type new/improved equipment will be employed will be identified in the scenario and confirmed in the data collectors' remarks/delays.

TABLE F-II-1 (Continued)

40	1.2.5.N	Repeat line No. 39 for each type of new/improved equipment employed. Also, identify separately any combinations of types of new/improved equipment.
41	1.2.5.N+1	Identify those incomplete immediate CAS requests conducted with type 1 new/improved equipment. The period(s) when this type new/improved equipment will be employed will be identified in the scenario and confirmed in the data collectors' remarks/delays.
42	1.2.5.N+M	Repeat line No. 41 for each type of new/improved equipment employed. Also, identify separating any combinations of types of new/improved equipment.
43	1.2.5	Those immediate CAS requests identified in line numbers 39 through 42 form the data base for those immediate CAS requests conducted during periods where new/improved equipment was employed.
44	1.2.6.1	Identify those complete immediate CAS requests conducted during a substantial air threat. The period(s) of substantial air threat will be identified in the scenario and confirmed through the data collectors' remarks/delays.
45	1.2.6.2	Identify those incomplete immediate CAS requests conducted during a substantial air threat. The period(s) of substantial air threat will be identified in the scenario and confirmed through the data collectors' remarks/delays.
46	1.2.6	The immediate CAS requests identified in line numbers 44 and 45 form the data base for those immediate CAS requests conducted during period(s) of a substantial air threat.
47	1.2.7.1	Identify those complete immediate CAS requests conducted during a substantial air defense threat. The period(s) of substantial air defense threat will be identified in the scenario and confirmed through the data collectors' remarks/delays.
48	1.2.7.2	Identify those incomplete immediate CAS requests conducted during a substantial air threat. The substantial period(s) of air defense threat will be identified in the scenario and confirmed through the data collectors' remarks/delays.
49	1.2.7	Those immediate CAS requests identified in line numbers 47 and 48 form the data base for those immediate CAS requests conducted during period(s) of a substantial air defense threat.
50	1.2.8.1	Identify those complete immediate CAS requests conducted during a target rich environment. The periods of target rich environment will be identified in the scenario.

TABLE F-II-1 (Continued)

51	1.2.8.2	Identify those incomplete immediate CAS requests conducted during a target rich environment. The periods of target rich environment will be identified in the scenario.
52	1.2.8	Those immediate CAS requests identified in line numbers 50 and 51 form the data base for those immediate CAS requests conducted during period(s) of a target rich environment.
53	1.2.9.1	Identify those complete immediate CAS requests conducted with type 1 ECM threat. The period(s) where this type ECM threat will be employed will be identified in the scenario and confirmed through the logs of the ECM force.
54	1.2.9.N	Repeat line No. 53 for each type of ECM employed, e.g., communication jamming, radar jamming, etc.
55	1.2.9.N+1	Identify those incomplete immediate CAS requests conducted with type 1 ECM threat. The period(s) where this type ECM threat will be employed will be identified in the scenario and confirmed through the logs of the EW unit.
56	1.2.9.N+M	Repeat line No. 55 for each type of ECM employed, e.g., communication jamming, radar jamming, etc.
57	1.2.9	The immediate CAS requests identified in line numbers 53 through 56 form the data base for those immediate CAS requests conducted during period(s) of an ECM threat.
58	1.2	Those immediate CAS requests identified in line numbers 23 through 57 form the data base for those immediate CAS requests conducted under deviation from Base Case.
59	1.3.1.1	Identify those complete immediate CAS requests conducted by type 1 aircraft. The type of aircraft is identified on the request data form.
60	1.3.1.N	Repeat line No. 58 for each type of aircraft employed, e.g., F-4, A-7, AH-1, etc.
61	1.3.1.N+1	Identify those incomplete immediate CAS requests conducted by type 1 aircraft. The type of aircraft is identified on the request data form.
62	1.3.1.N+M	Repeat line No. 61 for each type of aircraft employed, e.g., F-4, A-7, AH-1, etc.
63	1.3.1	Those immediate CAS requests identified in line numbers 59 through 62 form the data base for those immediate CAS requests conducted with the various types of aircraft employed.
64	1.3.2.1	Identify those complete immediate CAS requests conducted from ground alert resources.
65	1.3.2.2	Identify those incomplete immediate CAS requests conducted from ground alert resources.
66	1.3.3	Those immediate CAS requests identified in line numbers 64 and 65 form the data base for those immediate CAS requests conducted with ground alert resources.

TABLE F-II-1 (Continued)

67	1.3.3.1	Identify those complete immediate CAS requests conducted from ground alert forward resources.
68	1.3.3.2	Identify those incomplete immediate CAS requests conducted from ground alert forward resources.
69	1.3.3	Those immediate CAS requests identified in line numbers 67 and 68 form the data base for those immediate CAS requests conducted with ground alert forward resources.
70	1.3.4.1	Identify those complete immediate CAS requests conducted from air alert resources.
71	1.3.4.2	Identify those incomplete immediate CAS requests conducted from air alert resources.
72	1.3.4	The immediate CAS requests identified in line numbers 70 and 71 form the data base for those immediate CAS requests conducted with air alert resources.
73	1.3.5.1	Identify those complete immediate CAS requests conducted from deck alert resources.
74	1.3.5.2	Identify those incomplete immediate CAS requests conducted from deck alert resources.
75	1.3.5	Those immediate CAS requests identified in line numbers 73 and 74 form the data base for those immediate CAS requests conducted with deck alert resources.
76	1.3.6.1	Identify those complete immediate CAS requests conducted from diverted resources.
77	1.3.6.2	Identify those incomplete immediate CAS requests conducted from diverted resources.
78	1.3.6	Those immediate CAS requests identified in line numbers 76 and 77 form the data base for those immediate CAS requests conducted with diverted resources.
79	1.3.7.1	Identify those complete immediate CAS requests conducted from five minute alert status.
80	1.3.7.2	Identify those incomplete immediate CAS requests conducted from five minute alert status.
81	1.3.7	Those immediate CAS requests identified in line numbers 79 and 80 form the data base for those immediate CAS requests conducting from five minute alert resources.
82	1.3.8.1	Identify those complete immediate CAS requests conducted from fifteen minute alert status.
83	1.3.8.2	Identify those incomplete immediate CAS requests conducted from fifteen minute alert status.
84	1.3.8	Those immediate CAS requests identified in line numbers 82 and 83 form the data base for those immediate CAS requests conducted with fifteen minute alert status.
85	1.3.9.1	Identify those complete immediate CAS requests conducted from other than five and fifteen minute alert status.
86	1.3.9.2	Identify those incomplete immediate CAS requests conducted from other than five and fifteen minute alert status.

TABLE F-II-1 (Continued)

87	1.3.9	Those immediate CAS requests identified in line numbers 85 and 86 form the data base for those immediate CAS requests conducted with other than five or fifteen minute alert status.
88	1.3.10.1	Identify those complete immediate CAS requests conducted with adverse weather at the ground alert site. This will be identified through IFR conditions at launch/take off.
89	1.3.10.2	Identify those incomplete immediate CAS requests conducted with adverse weather at the ground alert site. This will be identified through IFR conditions at launch/take off.
90	1.3.10	Those immediate CAS requests identified in line numbers 88 and 89 form the data base for those immediate CAS requests conducted with adverse weather at the ground alert site.
91	1.3.11.1	Identify those complete immediate CAS requests conducted with weather in the target area. This will include CAS requests fulfilled with ASRT and those with weather delays/holds in the terminal area.
92	1.3.11.2	Identify those incomplete immediate CAS requests conducted with adverse weather in the target area. These will include CAS requests fulfilled with ASRT and those with weather delays/holds in the terminal area.
93	1.3.11	Those immediate CAS requests identified in line numbers 90 and 91 form the data base for those immediate CAS requests with weather in the terminal area.
94	1.3.12	Identify those complete immediate CAS requests with one pass on the target.
95	1.3.13	Identify those complete immediate CAS requests with more than one pass on the target.
96	1.3.14	Identify those complete immediate CAS requests conducted against personnel in the open.
97	1.3.15	Identify those complete immediate CAS requests conducted against personnel covered.
98	1.3.16	Identify those complete immediate CAS requests conducted against wheeled vehicles.
99	1.3.17	Identify those complete immediate CAS requests conducted against armored vehicles/tanks.
100	1.3.18	Identify those complete immediate CAS requests conducted against hardened structures.
101	1.3.19	Identify those complete immediate CAS requests conducted with a FAC(A) controller.
102	1.3.20	Identify those complete immediate CAS requests conducted with a FAC(G) controller.
103	1.3.21.1	Identify those complete immediate CAS requests conducted in support of an offensive operation.

TABLE F -II-1 (Continued)

104	1.3.21.2	Identify those incomplete immediate CAS requests conducted in support of an offensive operation.
105	1.3.21	Those immediate CAS requests identified in line numbers 103 and 104 form the data base for those immediate CAS requests conducted during an offensive operation.
106	1.3.22.1	Identify those complete immediate CAS requests conducted in support of a defensive operation.
107	1.3.22.2	Identify those incomplete immediate CAS requests conducted in support of a defensive operation.
108	1.3.22	Those immediate CAS requests identified in line numbers 106 and 107 form the data base for those immediate CAS requests conducted during a defensive operation.
109	1.3.23.1	Identify those complete immediate CAS requests conducted in support of a retrograde operation.
110	1.3.23.2	Identify those incomplete immediate CAS requests conducted in support of a retrograde operation.
111	1.3.23	Those immediate CAS requests identified in line numbers 109 and 110 form the data base for those immediate CAS requests conducted during a retrograde operation.
112	1.3.24.1	Identify those complete immediate CAS requests conducted in support of a special operation.
113	1.3.24.2	Identify those incomplete immediate CAS requests conducted in support of a special operation.
114	1.3.24	Those immediate CAS requests identified in line numbers 112 and 113 form the data base for those immediate CAS requests conducted during a special operation.
115	1.3.25	Identify those complete immediate CAS requests conducted with the target in open terrain.
116	1.3.26	Identify those complete immediate CAS requests conducted with the target in cluttered terrain.
117	1.3.27	Identify those complete immediate CAS requests conducted with the target marked with pyrotechnic smoke.
118	1.3.28	Identify those complete immediate CAS requests conducted with the target identified visually.
119	1.3.29	Identify those complete immediate CAS requests conducted with the target marked with panels.
120	1.3.30	Identify those complete immediate CAS requests conducted with the target marked with laser.
121	1.3.31	Identify those complete immediate CAS requests conducted with the target marked with other than visual, pyrotechnic smoke panels or laser.
122	1.3.32	Identify those completed immediate CAS requests conducted with assigned ordnance.
123	1.3.33	Identify those complete immediate CAS requests conducted with onboard ordnance.

TABLE F-II-1 (Continued)

124	1.3	Those immediate CAS requests identified in Line No. 59 thru 123 form the data base for those immediate CAS requests conducted with mission variables. Line items Nos. 59 thru 123 were for the total sample size. A separate identification of these variables for each of the paths identified in the Base Case (Line Nos. 125 thru 160) and for each of the deviations from Base Case (Line Nos. 23 thru 58) will be accomplished. Summations from the total sample size will be combined with the Base Case, deviations from Base Case, and the non-controllable mission variables in the form of Tables D-6 thru D-9 for the appropriate command and control system for CAS. Separate listing of variables for each controlled condition will be identified and tabulated.
125	1.4.1.1	For the Army/Air Force Command and Control Network for Close Air Support, identify those Base Case complete immediate CAS requests (Line No. 11) which initiate at battalion and are fulfilled by DASC ground alert resources (Path No. 1 in Table E-1).
126	1.4.1.7	Repeat Line No. 125 for each of the seven paths.
127	1.4.1.8	Identify by unique path number the various other paths a Base Case complete immediate CAS request might take in the network and so identify the requests which followed these paths.
128	1.4.1.9	For the Army/Air Force Command and Control Network for Close Air Support, identify those Base Case incomplete immediate CAS requests (Line No. 21) which initiate at battalion and are fulfilled by DASC ground alert resources (Path No. 1 in Table E-1).
129	1.4.1.15	Repeat Line No. 128 for each of the seven paths.
130	1.4.1.16	Using the same additional path identification used in Line No. 127, identify those incomplete immediate CAS requests accordingly.
131	1.4.1	Those immediate CAS requests identified in Line Nos. 125 thru 130 represent the distribution of Base Case conditions in the Army/Air Force Command and Control Network for CAS.
132	1.4.2.1	For the Army Command and Control Network for Attack Helicopter Close Air Support, identify those Base Case immediate CAS requests (Line No. 11) fulfilled with ground alert resources under battalion control.
133	1.4.2.6	Repeat Line No. 132 for each of the six paths identified in Table E-7.
134	1.4.2.7	Identify by unique path numbers the various other paths Base Case complete immediate CAS requests might take in the network and so identify the requests which followed these paths.

TABLE F-II-1 (Continued)

135	1.4.2.8	For the Army Command and Control Network for Attack Helicopter Close Air Support, identify those Base Case incomplete immediate CAS requests (Line No. 21) using path No. 1.
136	1.4.2.13	Repeat Line No. 135 for each of the six paths.
137	1.4.2.14	Using the same additional path identification used in Line No. 134, identify those incomplete immediate CAS requests accordingly.
138	1.4.3.1	For the Navy/Marine Corps Command and Control Network for Close Air Support (Control Afloat), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled with TACC/SACC air alert.
139	1.4.3.2	For the Navy/Marine Corps Command and Control Network for Close Air Support (Control Afloat) identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled with TACC/SACC Divert.
140	1.4.3.3	For the Navy/Marine Corps Command and Control Network for Close Air Support (Control Afloat), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled with TACC/SACC Deck Alert.
141	1.4.3.4	Identify by unique path numbers the various other paths Base Case complete immediate CAS requests might take in the Network and so identify the requests which followed these paths.
142	1.4.3.5	For the Navy/Marine Corps Command and Control Network for Close Air Support (Control Afloat), identify those Base Case incomplete immediate CAS requests (Line No. 11) fulfilled with TACC/SACC air alert.
143	1.4.3.6	For the Navy/Marine Corps Command and Control Network for Close Air Support (Control Afloat), identify those Base Case incomplete immediate CAS requests (Line No. 11) fulfilled with TACC/SACC Divert.
144	1.4.3.7	For the Navy/Marine Corps Command and Control Network for Close Air Support (Control Afloat), identify those Base Case incomplete immediate CAS requests (Line No. 11) fulfilled with TACC/SACC Deck Alert.
145	1.4.3.8	Using the same additional path identification used in Line No. 141, identify those incomplete immediate CAS requests accordingly.
146	1.4.4.1	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled by DASC controlled ground alert forward.
147	1.4.4.2	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled by DASC controlled air alert.

TABLE F-II-1 (Continued)

148	1.4.4.3	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled by DASC controlled ground alert.
149	1.4.4.4	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled by TACC controlled divert.
150	1.4.4.5	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled by TACC controlled air alert.
151	1.4.4.6	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case complete immediate CAS requests (Line No. 11) fulfilled by TACC controlled ground alert.
152	1.4.4.7	Identify by unique part number the various other paths Base Case complete immediate CAS requests might take in the network and so identify the requests which followed these paths.
153	1.4.4.8	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case incomplete immediate CAS requests (Line No. 21) using Path No. 1.
154	1.4.4.9	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case incomplete immediate CAS requests (Line No. 21) using Path No. 2.
155	1.4.4.10	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case incomplete immediate CAS requests (Line No. 21) using Path No. 3.
156	1.4.4.11	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case incomplete immediate CAS requests (Line No. 21) using Path No. 4.
157	1.4.4.12	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case incomplete immediate CAS requests (Line No. 21) using Path No. 5.
158	1.4.4.13	For the Navy/Marine Corps Command and Control Network for Close Air Support (control ashore), identify those Base Case incomplete immediate CAS requests (Line No. 21) using Path No. 6.
159	1.4.4.14	Using the same additional path identification used in Line No. 152, identify those incomplete immediate CAS requests accordingly.
160	1.4	Those immediate CAS requests identified in line numbers 125 through 159 form the data base for those immediate CAS requests conducted through the specific paths for analysis and other associated paths in the three command and control networks for CAS.

TABLE F-II-1 (Continued)

161	1	The various classifications of immediate CAS requests to be used in addressing the ten of the eleven JCS objectives (ANNEX A) are identified in Lines 02 through 160 above.
162	2.1.1.1	The time of first attempt to transmit a request/action to the next node is found in the data form questionnaires. These times are contained in the Request Phase only, as defined in the appropriate event definitions for the three command and control networks for CAS analyzed. The data questionnaire numbers associated with the request phase event numbers identified may be found in Tables E-6, E-12, E-17 or E-22.
163	2.1.1.2	The time of acknowledgement of a request at the present node is found in the data form questionnaires. The tables identified in Line No. 162 apply also to this time. Use the times recorded at the same node for this and Line No. 162 where possible. This will remove some error in the time synchronization.
164	2.1.1	<p>The node processing time may be determined through the following relation:</p> $\text{Processing Time} = \left\{ \begin{array}{l} \text{Time first attempt to} \\ \text{transmit request/} \\ \text{action to next node} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time request/action} \\ \text{acknowledged by the} \\ \text{present node} \end{array} \right\}$ <p>The processing times for the three command and control networks for CAS are identified in Tables E-3, E-9, E-14 or E-19.</p>
165	2.1	For each of the immediate CAS requests in the various classifications in Lines 2 through 160, calculate the processing time for each immediate CAS request for each classification (Line 2 through 160 above) within each command and control network for CAS. A system of identifying these processing times with the appropriate immediate CAS request is required for further analysis.
166	2.2.1.1	The time of acknowledgment of a request/action at the next node is found in the data form questionnaires. These times are contained in the request phase only as defined for the three command and control networks for CAS in the appropriate event definitions (Tables E-2, E-8, E-12, E-17 or E-22).
167	2.2.1.2	The time of first attempt to transmit a request/action to the next node is found in the same event definition and event/question relations in the tables identified in Line No. 165.
168	2.2.1	<p>The node-to-node communications may be determined through the following relation:</p> $\text{Communication Times} = \left\{ \begin{array}{l} \text{Time request/action} \\ \text{acknowledged by the} \\ \text{next node} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time first attempt} \\ \text{to transmit from} \\ \text{present node} \end{array} \right\}$ <p>The node-to-node communications time for the three command and control networks for CAS are identified in Tables E-4, E-10, E-15 and E-20.</p>

TABLE F-II-1 (Continued)

169	2.2	For each of the immediate CAS requests in the various classifications in Lines 2 through 160, calculate the node-to-node communications times for each immediate CAS request for each classification (Line 2 through 160 above) within each command and control network for CAS. A system of identifying these node-to-node communications times with the related immediate CAS request is required for further analyses.
170	2.3.1.1	The time of acknowledgement of a request/action at the next node is found in the data form questionnaires. These times are associated with the Request Phase only as defined in Line No. 166.
171	2.3.1.2	The time of acknowledgment of a request/action at the present node is found in the data form questionnaires. These times are associated with request phase only as defined in Line No. 163.
172	2.3.1	<p>The link time may be determined through the following relation:</p> $\text{Link Time} = \left\{ \begin{array}{l} \text{Time of Acknowledgment} \\ \text{of a request/action} \\ \text{at the next node} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time of acknowledgement} \\ \text{of a request/action} \\ \text{at the present node} \end{array} \right\}$ <p>The link times for the three command and control networks for CAS are identified in Tables E-5, E-11, E-16 and E-21. An alternate technique for link times may be determined through the following relation:</p> $\text{Link Time} = \left\{ \begin{array}{l} \text{Processing} \\ \text{Time} \end{array} \right\} + \left\{ \begin{array}{l} \text{Communications} \\ \text{Time} \end{array} \right\}$ <p>For each of the immediate CAS requests in the various classifications in Lines 2 through 160, calculate the link times. The sequence of link times is shown in Figures E-3, E-10, E-12 and E-13. A system of identifying these link times with the appropriate CAS request is required for further analyses.</p>
173	2.3.2.1	The time of acknowledgment of a request by the delivery agent, a launch order (E-01) or an execution order (E-02), is found on the data form questionnaires. For each of the three command and control networks for CAS refer to Tables E-24 through E-27 to determine the appropriate questions.
174	2.3.2.2	The start time for each of the three command and control networks for CAS is different for each network. The appropriate event identifying the initiation of an immediate CAS request is defined in Tables E-2, E-8, E-13 and E-18. The appropriate questions are identified in Tables E-6, E-12, E-17, and E-22.
175	2.3.2	<p>The Request Phase elapse time may be determined through the following relation:</p> $\text{Request Phase Elapse Time} = \left\{ \begin{array}{l} \text{Time of Acknowledgment} \\ \text{by Delivery Agent} \end{array} \right\} - \left\{ \begin{array}{l} \text{Request Phase} \\ \text{Start Time} \end{array} \right\}$ <p>The Request Phase elapse time may also be determined through a summation of the link times associated with the CAS request being analyzed. Calculate the Request Phase elapse time for each immediate CAS request in the</p>

TABLE F-II-1 (Continued)

various classifications in Lines 2 through 160 within each command and control network for CAS. A system of identifying the Request Phase elapse time with the appropriate CAS request is required for further analysis.

- 176 2.3.3.1 The time at which the flight leader reports first weapons release (E-9) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS.
- 177 2.3.3.2 The time at which the flight cleared to attack the designated target (FAC/controller mission) (E-8) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed.
- 178 2.3.3 The first pass target attack time may be determined through the following relation:
- $$\text{First Pass Target Attack Time} = \left\{ \begin{array}{l} \text{Time Flight Reports First Weapons Release} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time Flight Cleared to Attack Target} \end{array} \right\}$$
- Calculate the first pass target attack time for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the first pass target attack times with the appropriate immediate CAS request is required for further analysis.
- 179 2.3.4.1 The time at which the flight cleared to attack the designated target (FAC/controller missions) (E-8) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed.
- 180 2.3.4.2 The time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed.
- 181 2.3.4 The target acquisition time may be determined through the following relation:

$$\text{Target Acquisition Time} = \left\{ \begin{array}{l} \text{Flight Cleared to Attack The Target} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time voice communication has been established between the ASRT controller or FAC and the flight leader and the aircraft is 20,000 meters from the target the first time.} \end{array} \right\}$$

Calculate the target acquisition time for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the target acquisition times with the appropriate immediate CAS request is required for further analysis.

TABLE F-II-1 (Continued)

182 2.3.5.1 The time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed.

183 2.3.5.2 The time at which the lead aircraft leaves the surface of the ground or the deck of an aircraft carrier (E-3) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed.

184 2.3.5 The transit time may be determined through the following relation:

$$\text{Transit Time} = \left\{ \begin{array}{l} \text{Time voice communication has been established between the ASRT controller or FAC and the flight leader and the aircraft is 20,000 meters from the target for the first time.} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time lead aircraft leaves the surface of the ground or the deck of an aircraft carrier.} \end{array} \right\}$$

Calculate the transit time for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the transit time with the appropriate immediate CAS request is required for further analysis.

185 2.3.6.1 The time at which the lead aircraft leaves the surface of the ground or the deck of an aircraft carrier (E-3) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS.

186 2.3.6.2 The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01), the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02), or the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the command and control networks for CAS being analyzed.

187 2.3.6 The air crew reaction time may be determined through the following relation:

$$\text{Air Crew Reaction Time} = \left\{ \begin{array}{l} \text{What is the time at which the lead aircraft leaves the surface of the ground or the deck of an aircraft carrier (E-3).} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time flt ldr on ground alert or deck alert acknowledges receipt of a launch order or, time flt ldr on air alert acknowledges receipt of an order to execute, or what is the time at which the flt ldr acknowledges instructions assigning him a new CAS mission (E-12).} \end{array} \right\}$$

TABLE F-II-1 (Continued)

Calculate air crew reaction time for each complete immediate CAS request in the various classifications (Line numbers 2 through 160) within each command and control network for CAS. A system to identify air crew reaction times with the appropriate immediate CAS request is required for further analysis.

188	2.3.7.1	The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01), the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02), the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12) is found in the data form questionnaires. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed.
189	2.3.7.2	The time at which the flight leader acknowledges receipt of a message from a control agency that the mission cannot be completed, or the time at which a controller/coordinator acknowledges receipt of a message from the flight leader that the mission cannot be completed (E-18) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed.
190	2.3.7	The C&C abort reaction time may be determined through the following relation:

$$\text{C\&C abort reaction Time} = \left\{ \begin{array}{l} \text{Time flt ldr on} \\ \text{ground alert or} \\ \text{deck alert} \\ \text{acknowledges} \\ \text{receipt of a} \\ \text{launch order,} \\ \text{time flt ldr on} \\ \text{air alert} \\ \text{acknowledges} \\ \text{receipt of an} \\ \text{order to execute,} \\ \text{or the time at} \\ \text{which the flt} \\ \text{ldr acknowledges} \\ \text{instructions} \\ \text{assigning him} \\ \text{a new CAS mission.} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time flt ldr} \\ \text{acknowledges} \\ \text{receipt of a} \\ \text{message from a} \\ \text{control agency} \\ \text{that the mission} \\ \text{cannot be completed,} \\ \text{time controller/} \\ \text{coordinator acknowl-} \\ \text{edges receipt of a} \\ \text{message from the} \\ \text{flt ldr that the} \\ \text{mission cannot be} \\ \text{completed.} \end{array} \right\}$$

Calculate the C&C abort reaction time for each complete immediate CAS request in the various classifications (Line numbers 2 through 160) within each command and control network for CAS. A system to identify the C&C abort reaction times and the appropriate immediate CAS request is required for further analysis.

TABLE F-II-1 (Continued)

191	2.3.8.1	The time at which the flight leader acknowledges receipt of a message from a control agency that the mission cannot be completed, or the time at which a controller/coordinator acknowledges receipt of a message from the flight leader that the mission cannot be completed (E-18) is found in the data form questionnaires.
192	2.3.8.2	The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01), the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission (E-02), or the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12) is found in the data form questionnaire.
193	2.3.8	The delay time due to mission abort may be determined through the following relation:
		$\text{Delay Time Due to Mission Abort} = \left[\begin{array}{l} \text{Flt ldr acknowl-} \\ \text{edges receipt of} \\ \text{a message from} \\ \text{a control agency} \\ \text{that the mission} \\ \text{cannot be com-} \\ \text{pleted, or time} \\ \text{coordinator} \\ \text{acknowledges} \\ \text{receipt of a} \\ \text{message from} \\ \text{the flt ldr} \\ \text{that the mission} \\ \text{cannot be com-} \\ \text{pleted.} \end{array} \right] - \left[\begin{array}{l} \text{Time flt ldr on} \\ \text{ground alert or} \\ \text{deck alert acknowl-} \\ \text{edges receipt of} \\ \text{a launch order,} \\ \text{time flt ldr on} \\ \text{air alert acknowl-} \\ \text{edges receipt of} \\ \text{an order to} \\ \text{execute a CAS} \\ \text{mission, or the} \\ \text{time flt ldr} \\ \text{acknowledges} \\ \text{instructions} \\ \text{assigning him a} \\ \text{new CAS mission.} \end{array} \right]$
		Calculate the delay time due to mission abort for each complete immediate CAS request in the various classifications (Line numbers 2 through 160) within each command and control network for CAS. A system to identify the delay time due to mission aborts with the appropriate immediate CAS request is required for further analysis.
194	2.3.9.1	The time at which the flt ldr on ground alert or deck alert acknowledges receipt of a launch order (E-01), the time at which the flt ldr on air alert acknowledges receipt of an order to execute a CAS mission (E-02); or the time at which the flt ldr acknowledges instructions assigning a new CAS mission (E-12) is found in the data form questionnaire.
195	2.3.9.2	The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01), the time at which the flight leader on air alert acknowledges receipt of an order to execute a CAS mission, or the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12) is found in the data form questionnaire.
196	2.3.9	The mission delay time (for requests which have an abort and a tasking of a new mission) may be determined through the following relation:

TABLE F-II-1 (Continued)

Mission Delay Time (for Requests which have an Abort and a Tasking of a New Mission)	=	Time flt ldr on ground alert or deck alert acknowledges receipt of a launch order, time flt ldr on air alert acknowledges receipt of an order to execute, or time flt ldr acknowledges instructions assigning a new CAS mission.	-	Time flt ldr on ground alert or deck alert acknowledges receipt of a launch order, time flt ldr on air alert acknowledges receipt of an order to execute, or time flt ldr acknowledges instructions assigning him a new CAS mission.
--	---	--	---	--

Calculate the mission delay time (for requests which have an abort and a tasking of a new mission) for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the mission delay time (for requests which have an abort and a tasking of a new mission) with the appropriate immediate CAS request is required for further analysis.

- 197 2.3.10.1 The time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for each of the command and control networks for CAS being analyzed.
- 198 2.3.10.2 The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01), the time at which the flight leader on air alert acknowledges receipt of an order to execute (E-02), or the time at which the flight leader acknowledges instructions assigning him a new CAS mission (E-12) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed.
- 199 2.3.10 The alert posture to terminal controller link time may be determined through the following relation:

Alert posture to terminal controller link time.	=	Time voice communication has been established between the ASRT controller or FAC and the flt ldr, and the aircraft is 20,000 meters from the target for the first time.	-	Time flt ldr on ground alert or deck alert acknowledges receipt of a launch order, time flt ldr on air alert acknowledges receipt of an order to execute, or the time flt ldr acknowledges instructions assigning him a new CAS mission.
---	---	---	---	--

TABLE F-II-1 (Continued)

Calculate the alert posture to terminal controller link time for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the alert posture to terminal controller link time with the appropriate immediate CAS request is required for further analysis.

- 200 2.3.11.1 The time at which the flt ldr reports first weapons release (E-9) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed.
- 201 2.3.11.2 The time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the command and control networks for CAS being analyzed.
- 202 2.3.11 The terminal controller to target link time may be determined through the following relation:

$$\text{Terminal controller to target Link Time} = \left\{ \begin{array}{l} \text{Time flt ldr} \\ \text{reports first} \\ \text{weapons} \\ \text{release.} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time voice} \\ \text{communication} \\ \text{has been estab-} \\ \text{lished between the} \\ \text{ASRT controller or} \\ \text{FAC and the flt} \\ \text{ldr, and the} \\ \text{aircraft is} \\ \text{20,000 meters} \\ \text{from the target} \\ \text{for the first} \\ \text{time.} \end{array} \right\}$$

Calculate the terminal controller to target link time for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the terminal controller to target link time with the appropriate immediate CAS request is required for further analysis.

- 203 2.3.12.1 The time at which the flight was cleared to attack the designated target (FAC/controller missions) (E-8) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed.
- 204 2.3.12.2 The time at which voice communication has been established between the ASRT controller or FAC and the flight leader, and the aircraft is 20,000 meters from the target for the first time (E-6) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed.
- 205 2.3.12 The total terminal control time may be determined through the following relation:

TABLE F-II-1 (Continued)

$$\text{Total Terminal Control Time} = \left\{ \begin{array}{l} \text{Time flight} \\ \text{cleared to} \\ \text{attack.} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time voice} \\ \text{communication} \\ \text{has been} \\ \text{established} \\ \text{between the} \\ \text{ASRT controller} \\ \text{or FAC and the} \\ \text{flt ldr, and} \\ \text{the aircraft is} \\ \text{20,000 meters} \\ \text{from the target} \\ \text{for the first} \\ \text{time.} \end{array} \right\}$$

Calculate the total terminal control time for each complete immediate CAS request in the various classifications within each command and control network for CAS. A system to identify the total terminal control time and the appropriate immediate CAS request is required for further analysis.

- | | | |
|-----|----------|--|
| 206 | 2.3.13.1 | The time at which the flight leader reports first weapons release (E-9) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for each of the three command and control networks for CAS being analyzed. |
| 207 | 2.3.13.2 | The time at which the flight leader on ground alert or deck alert acknowledges receipt of a launch order (E-01) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed. |
| 208 | 2.3.13 | The Execution Phase elapsed time may be determined through the following relation: |

$$\text{Execution Phase elapsed Time.} = \left\{ \begin{array}{l} \text{Time flt ldr} \\ \text{reports first} \\ \text{weapons release.} \end{array} \right\} - \left\{ \begin{array}{l} \text{Time flt ldr on} \\ \text{ground alert or deck} \\ \text{alert acknowledges} \\ \text{receipt of a launch} \\ \text{order, the time flt} \\ \text{ldr on air alert a} \\ \text{acknowledges} \\ \text{receipt of an} \\ \text{order to execute} \\ \text{a CAS mission, or} \\ \text{time flt ldr} \\ \text{acknowledges} \\ \text{instructions} \\ \text{assigning him a} \\ \text{new CAS mission.} \end{array} \right\}$$

Calculate the Execution Phase elapsed time for each complete immediate CAS request in the various classifications (Lines 2 through 160) within each command and control network for CAS. A system to identify the Execution Phase elapsed time with the appropriate immediate CAS request is required for further analysis.

- | | | |
|-----|----------|--|
| 209 | 2.3.14.1 | The time at which the flight leader reports first weapons release (E-9) is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed. |
| 210 | 2.3.14.2 | The start time of the Request Phase is found in the data form questionnaire. The appropriate question is identified in Tables E-23 through E-26 for the three command and control networks for CAS being analyzed. |

TABLE F-II-1 (Continued)

211	2.3.14	<p>The immediate CAS request total elapsed time may be determined through the following relation:</p> $\text{Immediate CAS request Total Elapsed Time} = \left\{ \begin{array}{l} \text{Time flt ldr} \\ \text{reports first} \\ \text{weapons release.} \end{array} \right\} - \left\{ \begin{array}{l} \text{Start time of} \\ \text{the Request} \\ \text{Phase.} \end{array} \right\}$ <p>Calculate the immediate CAS request total elapsed time for each complete immediate CAS request in the various classifications (Line 2 through 160) within each command and control network for CAS. A system to identify the immediate CAS request total elapsed time with the appropriate immediate CAS request is required for further analysis.</p>
212	2.3	<p>The various elapsed times for each of the immediate CAS requests for each classification of request (Lines 2 through 160) within each command and control network for CAS are contained in Lines 170 through 220 above.</p>
213	2.4	<p>For each immediate CAS request, for each path identified in Line No. 160 above within each command and control network for CAS, calculate the total processing time in the Request Phase. The total processing is the summation of the various processing times at each node processing the immediate CAS request. If the sample size permits, a like analysis of the deviations from Base Case should be conducted. If the sample size is too small to subdivide into the various paths for one or all of the deviations from Base Case aggregate all CAS requests and determine the total processing for each CAS request.</p>
214	2.5	<p>For each immediate CAS request, for each path identified in Line No. 160 above within each command and control network for CAS, calculate the total communication time in the request phase. The total communication time is the summation of the various communication times between each node processing the immediate CAS request. If the sample size permits, a like analysis of the deviations from Base Case should be conducted. If the sample size is too small to subdivide into the various paths for one or all of the deviations from Base Case aggregate all CAS requests and determine the total communication time for each CAS request.</p>
215	2	<p>The various elapsed times for each of the immediate CAS requests for each classification of request (Lines 2 through 160) within each command and control network for CAS are contained in Lines 160 through 220 above.</p>
216	3.1	<p>The numbers of samples in the various classifications identified in "1" above may not be sufficient to obtain statistical parameters with a reasonable degree of confidence within the various time categories in "2" above for the various classifications in "1" above. Sample sizes should be pooled where possible to obtain the best estimates of elapsed/response times. An analysis of variance is suggested for the pooling with gap tests to identify specifically which sample sets may be pooled.</p>
217	3.2.1	<p>The minimum time is the least of the sample of times.</p>

TABLE F-II-1 (Continued)

- 218 3.2.2 The mean time is defined as the most reasonable typical value in the sense that it will occur where the observations cluster. It is defined as follows:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

- 219 3.2.3 The median time is defined as the middle value when the observations are arranged in order of magnitude, i.e., the value that has half the observations above it and half below.

- 220 3.2.4 The maximum time is the maximum of the sample of times.

- 221 3.2.5 The standard deviation (σ) is defined as the square root of the average squared deviation from the mean, i.e.,

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$$

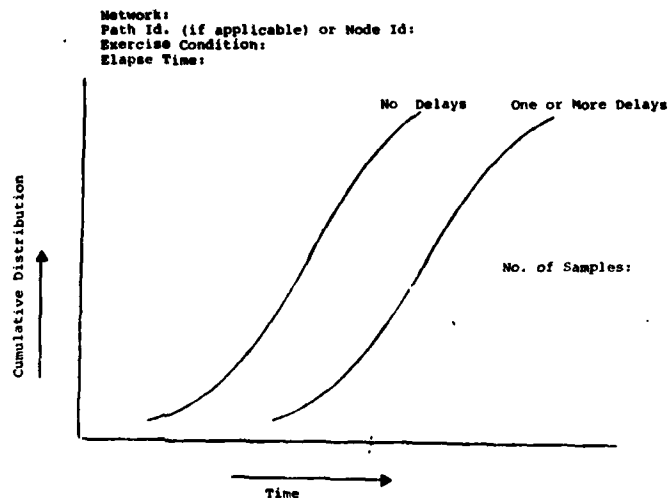
- 222 3.2.6 The confidence limits on the mean should be identified.

- 223 3.2 Where sample size permits, pooled if feasible, the statistical parameters identified in Line No. 226 through 231 above should be determined for each classification in "1" above for each applicable time in "2" above. These values should be tabulated for each network path for base case conditions and deviation from base case conditions if sample size permits. Fill in only those applicable entries. If there is insufficient data in the deviation from base case to subdivide into specific paths an aggregated value for the deviation should be used. A sample display is shown below. Where sample size permits the statistical parameters for the mission variables should be determined. A sample display is shown for the transit time for the alert posture. Similar displays should be developed for other appropriate times and for each category of mission variables. The above analysis will be conducted for each of the three command and control networks.

DESCRIPTION	SAMPLE SIZE	MIN	MEAN	MAX	STANDARD DEVIATION
Total Request/Mission Time					
Request Phase					
Link Time (A1-A4)					
Processing Time (A1)					
Communication Time (A1-A4)					
Link Time (A4-A5)					
(repeat for each link)					
Execution Phase					
Alert Posture to Terminal Controller Link Time					
Total Terminal Control Time					
Total Target Attack Time					
Total Mission Abort Delay Time					
Terminal Controller to Target Link Time					
Delay Time due to Mission Abort					
C&C Abort Reaction Time					
Air Crew Reaction Time					
Transit Time					
Target Acquisition Time					
Target Attack Time					
Target Reattack Time					

TABLE F-II-1 (Continued)

For each of the classifications in "1" above, determine the cumulative distribution of the appropriate times identified in "2" above. These cumulative distributions will be constructed where the sample size permits. The data points will be fitted, if possible, to some mathematical distribution.



For each of the paths identified for analysis in the three command and control networks for CAS, a time line will be constructed. A sample is shown below:

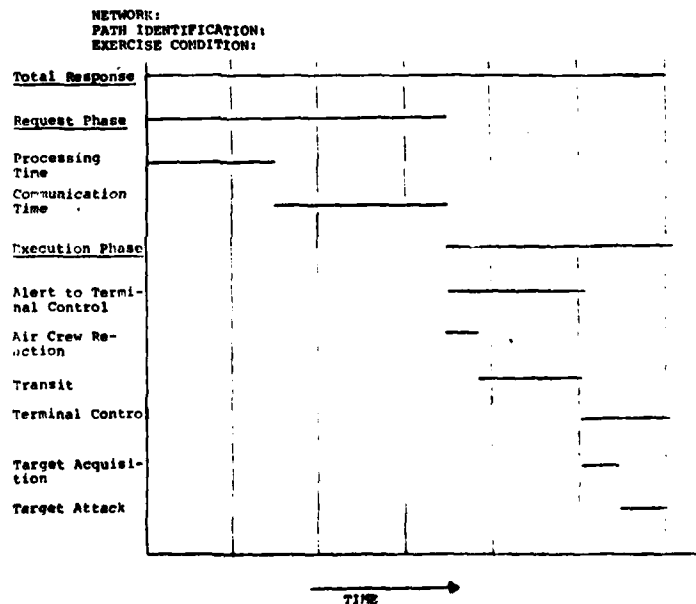


TABLE F-II-1 (Continued)

226	3	The quantifiable data analysis and display techniques are outlined in Lines 225 through 234. The final analysis and displays are not limited to those shown. They are representative of the scheme one might use.
227	4.1.1	For each classification in "1" above, determine the number of complete immediate CAS requests with no delays within each command and control network for CAS.
228	4.1.2	For each classification in "1" above, determine the number of incomplete immediate CAS requests with no delays.
229	4.1	The number of immediate CAS requests with no delays are identified in Lines 236 and 237.
230	4.2.1	For each classification in "1" above, determine the number of complete immediate CAS requests with one delay in the Request Phase.
231	4.2.2	For each classification in "1" above, determine the number of complete immediate CAS requests with one delay in the Execution Phase.
232	4.2.3	For each classification in "1" above, determine the number of complete immediate CAS requests with one delay in both phases.
233	4.2.4	For each classification in "1" above, determine the number of incomplete immediate CAS requests with no delay in the Request Phase.
234	4.2.5	For each classification in "1" above, determine the number of complete immediate CAS requests with no delay in the execution phase.
235	4.2.6	For each classification in "1" above, determine the number of complete immediate CAS requests with one delay in both phases.
236	4.2	The number of immediate CAS requests with one delay in each phase and in both phases are identified in Lines 239 through 244 for each classification. If the sample size is not sufficient, the above should be repeated for one and more delay. Otherwise, repeat the same steps for two, three and four and more delays. Include in these delays the aborts which resulted in completed missions. From these values calculate the frequency of delays. Tabulate the data as follows: (The numbers are representative and shown for example only)

NETWORK:

EXERCISE CONDITION:

PATH ID. (IF APPLICABLE):

TOTAL NUMBER OF MISSIONS: 100

TOTAL NUMBER OF MISSIONS WITH DELAYS: 36

TOTAL NUMBER OF DELAYS: 63

PHASE	NO. MISSIONS WITH DELAYS	NO. OF DELAYS	FREQUENCY OF A DELAYED MISSION
REQUEST	10	20	10%
EXECUTION	8	10	3%
(TRANSIT)	(5)	(10)	(5%)
(TARGET AREA)	(3)	(4)	(3%)
REQUEST AND EXECUTION	18	25	18%

TABLE F-II-1 (Continued)

		FREQUENCY OF MULTIPLE DELAYS PER PHASE				
		ONE	TWO	THREE	FOUR	FIVE OR MORE
		60%	30%	5%	2%	3%
		90%	3%	6%	1%	
		(80%)	(10%)	(10%)	()	()
		(90%)	(---)	(5%)	(5%)	()
		75%	10%	20%	5%	
237	4.3.1	For each classification in "1" above, determine the number of complete immediate CAS requests with no aborts.				
238	4.3.2	For each classification in "1" above, determine the number of incomplete immediate CAS requests with no aborts.				
239	4.3	The number of immediate CAS requests with no aborts are identified in Lines 239 through 247.				
240	4.4.1	For each classification in "1" above, determine the number of complete immediate CAS requests with one or more aborts.				
241	4.4.2	For each classification in "1" above, determine the number of incomplete immediate CAS requests with one or more abort.				
242	4.4	The number of immediate CAS requests with one or more aborts are identified in Lines 246 through 250. For each classification, calculate the frequency of aborts. From these values calculate the frequency of aborts. Tabulate the values with the cancellation analysis below.				
243	4.5.1	For each classification in "1" above determine the number of complete/incomplete immediate CAS requests with no cancellations.				
244	4.5	The number of immediate CAS requests with no cancellations are identified in Line 252.				
245	4.6	The number for each classification in "1" above determine the number of immediate CAS requests with cancellations. Calculate the frequency of cancellations. Tabulate the frequency of aborts and cancellations as follows:				

NETWORK:

EXERCISE
CONDITION

<u>NO. OF</u> <u>ABORTS</u>	<u>FREQ. OF</u> <u>OCCURRENCE</u>	<u>NUMBER OF</u> <u>CANCELLATIONS</u>	<u>FREQ. OF</u> <u>OCCURRENCE</u>
--------------------------------	--------------------------------------	--	--------------------------------------

BASE CASE

Deviations from Base Case:

1. Night Conditions
2. Reduced Weather/vis
3. Damaged CAS Command & Control Sites
4. Secure Voice
5. New Equipments
6. Substantial Enemy Air Threat
7. Substantial Enemy Air Defense Threat
8. Target Rich Environment
9. ECM Threat

Mission Variables

TABLE F-II-1 (Continued)

246 4.7 For each classification in "1" above determine the cumulative distribution of no delays and for the subdivision identified in Line 245 above. Plot the distribution as shown below. The difference between the distribution indicates the level the delay affected the request fulfillment. A plot should be made for times at selected nodes for the various classifications. Through analysis of the delays, some inference to the problems encountered may be made.

247 4 The methodology and cumulative distribution of selected paths/nodes/times for each classification in "1" above where sufficient data sample sizes exist for delays, aborts and cancellations are outlined in Lines 236 through 255.

248 Reason codes for delays, aborts and cancellations:

01 Comm Security	16 WX Conditions
02 ECM	17 Tgt ID-Flt Ldr
03 Authn Procd's	18 Lost Tgt-FAC
04 Comm Satur't'n	19 C&C Elem Malf
05 RF Interfer	20 Frndly Loc Info
06 Comm Incompat	21 Enmy Posn Info
07 Int'rm't Comm	22 Inacc Tgt Info
08 Fire Spt Coord	23 Atk Acft Malf
09 Air Def Coord	24 Crtlr Out Posn
10 Airspace Coord	25 Atk Acft Posn
11 Altn Fire Spt	26 Insuf Fuel
12 Gnd Auth Clnc	27 Red Smoke
13 Safety	28 Enemy Air Acty
14 FAA Coord	29 Admin Hold
15 C&C Elem Cap	30 Other

249 5.1.1 For each classification in "1" above, determine the number of complete immediate CAS requests with a single type 1 delay in Request Phase, Execution Phase and both phases.

250 5.1.N Repeat Line No. 258 for each type of delay.

251 5.1.N+1 For each classification in "1" above, determine the number of incomplete immediate CAS requests with a single type 1 delay in Request Phase, Execution Phase and both phases.

252 5.1.N+M Repeat Line No. 260 for each type of delay.

253 5.1 The distribution of the causes of delays by phase and by reason is identified in Line No. 258 through 261 above. A suggested tabulation of these causes by place is shown below:

PHASE	NO. OF REQUESTS W/ONE DELAY	COMM SEC	ECM	etc.
REQUEST	12	2	1	
(TRANSIT)	8		1	
(TARGET AREA)	3			
EXECUTION	16			
REQUEST AND EXECUTION	18			

(Values are representative)

TABLE F-II-1 (Continued)

254

5.2

Repeat Line No. 259 through 261 for combinations of delays. Display the findings as follows:

NETWORK:

EXERCISE CONDITIONS/VARIATION

NODE/LOCATION	NR. REQUESTS	COMBINATION
BN CP	3	03 01 08
	2	07 03

255

5.3.1

For each classification in "1" above, determine the number of complete immediate CAS requests with a single type 1 abort in Request Phase, Execution Phase and both phases. (Values are representative)

256

5.3.N

Repeat Line No. 264 for each type of abort.

257

5.3.N+1

For each classification in "1" above, determine the number of incomplete immediate CAS requests with a single type 1 abort in Request Phase, Execution Phase and both phases.

258

5.3.N+M

Repeat Line 266 for each type of abort.

259

5.3

The distribution of the causes of aborts by phase and by reason is identified in Line No. 258 through 261 above. A suggested tabulation of these causes by phase is shown below:

NETWORK:

EXERCISE CONDITION/VARIATION:

PHASE	REQUEST	REASON		etc
	W/ONE ABORT	INSUF FUEL (26)	ENEMY AIR (28)	
TRANSIT				
TARGET AREA				
EXECUTION PHASE				

260

5.4

Repeat lines 264 through 268 for combinations of aborts. Display the findings as follows:

NETWORK:

EXERCISE CONDITION/VARIATION:

NODE LOCATION	NR. REQUESTS	COMBINATION
DASC	2	08 04 16
	3	09 07
etc		

(values are representative)

TABLE F-II-1 (Concluded)

261 5.5.1 For each classification in "1" above, determine the number of immediate CAS requests cancelled with type 1 reason.

262 5.5.N Repeat Line No. 270 for each type cancellation.

263 5.5 The distribution of the causes of cancellations is identified in Lines 270 and 271. Display the findings as follows:

NETWORK:

EXERCISE CONDITION/VARIATION

NODE	NUMBER	REASON
DASC	2	Use Army Resources
DIW/TACP	1	Use Army Resources
etc.		

(Values representative)

264 5.6 Identify the various causes of delays and aborts identified in Lines 258 through 272 above by CAS Validation objectives. The various delays associated with the objectives are listed below:

265 5 The distribution of causes of delays, aborts, and cancellations is identified in Lines 257 through 273. A summary of the causes of delays, aborts and cancellations is shown below:

NETWORK:				N°	TOTAL
CAUSE	01	02	03		
EXERCISE CONDITION/VARIATIONS					
BASE CASE	//	//	//	//	//
PATH 1					
...					
PATH "H"	//	//	//	//	//
DEVIATION FROM BASE CASE	//	//	//	//	//
NIGHT	//	//	//	//	//
ECM	//	//	//	//	//
ETC.	//	//	//	//	//
ALERT STATUS	//	//	//	//	//
AIR ALERT	//	//	//	//	//
GROUND ALERT	//	//	//	//	//
DIVERT	//	//	//	//	//
TACTICAL SITUATION	//	//	//	//	//
DEFENSE	//	//	//	//	//
OFFENSE	//	//	//	//	//
RETROGRADE	//	//	//	//	//

* - WHERE "H" IS THE NUMBER OF CAUSES OF DELAY/ABORT/CANCELLATION.
ENTRIES IN THE TABLE WILL BE THE NUMBER OF DELAYS/ABORTS/CANCELLATIONS.

ANNEX G

DATA REDUCTION

1. General. The data reduction process will consist of two main phases.

a. The initial phase will be on site during the exercise and will involve manual sorting, review, and tabulation procedures.

b. The second phase will be at USREDCOM Headquarters and will involve computer processing to prepare and update a data bank and provide outputs to accommodate detailed analyses.

2. Data Sources.

a. The data collected for reduction will be obtained from the CAS exercise program. Data will be collected at key points within the command and control systems in each exercise. Trained data collectors record the required data on specially prepared data collection forms. These forms will be the primary input for a data reduction. (Data Form Questions are contained in Annex C.)

b. A Voice Recording System (VRS) will provide supplementary information to the manual data collection forms. This system records radio or wire transmissions from several communications channels. Transmissions are recorded simultaneously on multi-channel tape along with a synchronous time signal which provides the precise time of each transmission. Contractor personnel assigned to the Data Reduction Agency will extract data from the VRS tapes as required to augment or corroborate manually collected data.

c. On selected exercises, the RMS will be utilized. This system collects data from which the three dimensional position (x-y-z) coordinates of selected exercise participants can be precisely calculated for any given time. Personnel assigned to the Data Reduction Team will review the computer printouts for completeness and credibility. Computer listings and computer tapes will be labeled to permit any future desired analysis.

d. Other supplemental data will be obtained from the player unit working records.

3. Manual Data Reduction.

a. The general flow of total data reduction and processing is shown in Figures G-1 and G-2. The manual data processing effort, Figure G-1, begins on the exercise site with a collation of field exercise data forms. Quality control procedures will then be instituted to insure completeness and correctness of all forms. Once this has been accomplished, manual data forms will be catalogued for ease of reference and eventual storage. VRS tapes will also be labeled in such a way as to expedite data processing.

b. The next step in the data reduction process is to correlate all collected data, on a mission by mission basis, to establish credibility and to identify missing or suspect data for further search. To permit a methodical procedure for following a complete request/mission, to compare time events for proper sequence, and to relate events recorded by more than one data collector, manual spread sheet forms will be used. A sample form is shown in Figure G-3.

c. In addition to the time event sequence verification, a complete tabulation will be made of all variables and conditions that apply to each mission. This is normally tabulated on the CAS Coding Form, Mission Data, Figure G-4, where

it is readily apparent that data is missing. Multiple choice entries are used, when possible, for ease and efficiency of data reduction. Table G-1 explains the descriptive column headings which are abbreviated on the Mission Data Form.

d. After review and confirmation that the request/mission description and time sequence is credible, a graphic timeline will be prepared which highlights the node-to-node time sequences and durations. Figure 5 presents a sample timeline.

e. Since the culmination of the manual data processing task is to provide a data bank of relevant information for analysis, coding for keypunch cards will be performed. The CAS Coding Form, Mission Data, Figure G-4, and the CAS Coding Form, Node Data, Figure G-6, will be used by keypunch operators to prepare card decks. The preparation of the Mission Form has already been discussed in paragraph (c) above. The Node Data Coding Form will be prepared from the finalized time event spreadsheet, Figure 3.

f. On-site keypunching is feasible if facilities permit, although it is normally planned to perform keypunching at REDCOM Headquarters.

g. Duplicate data bank card decks can be prepared to meet the needs of other agencies.

4. AUTOMATED DATA PROCESSING.

a. Figure G-2 presents a flow diagram of the data processing to be conducted at REDCOM Headquarters subsequent to each exercise. Coding forms will normally be converted to keypunch cards at REDCOM Headquarters although this task may be completed at the exercise site.

b. Completed card deck data will be processed on the USREDCOM Honeywell 6060 computer. The first program is the FORTRAN EDIT program which matches all input data against a dictionary of accepted codes and conditions. All input data will be in the format of 1-6 alphanumeric character representing codes or abbreviations. All alpha data is compared to a master list of accepted words to determine validity. All numeric data is tested for reasonableness within certain predefined edit programs. Errors are identified and printed on listings to facilitate rapid checks and corrections. Accepted (as corrected) data will then be placed into disk storage on the REDCOM computer.

c. A highly flexible group of sort programs will be utilized to retrieve mission data by any combination of variables, conditions or restrictions. For example, a tabular listing can be produced showing all missions flown under any specific set of terms and conditions. Another sort program capability is to compute selected times such as transit times and to list these for all missions meeting prescribed conditions. Figure G-7 shows a standard printout of the chronological history of a single request/mission. Event-by-event time sequences are apparent.

d. Analysis programs will permit automation of analysis procedures wherever possible. These programs will present exercise results in statistical formats which, when merged with the subjective data, can support the findings and conclusions in the final report.

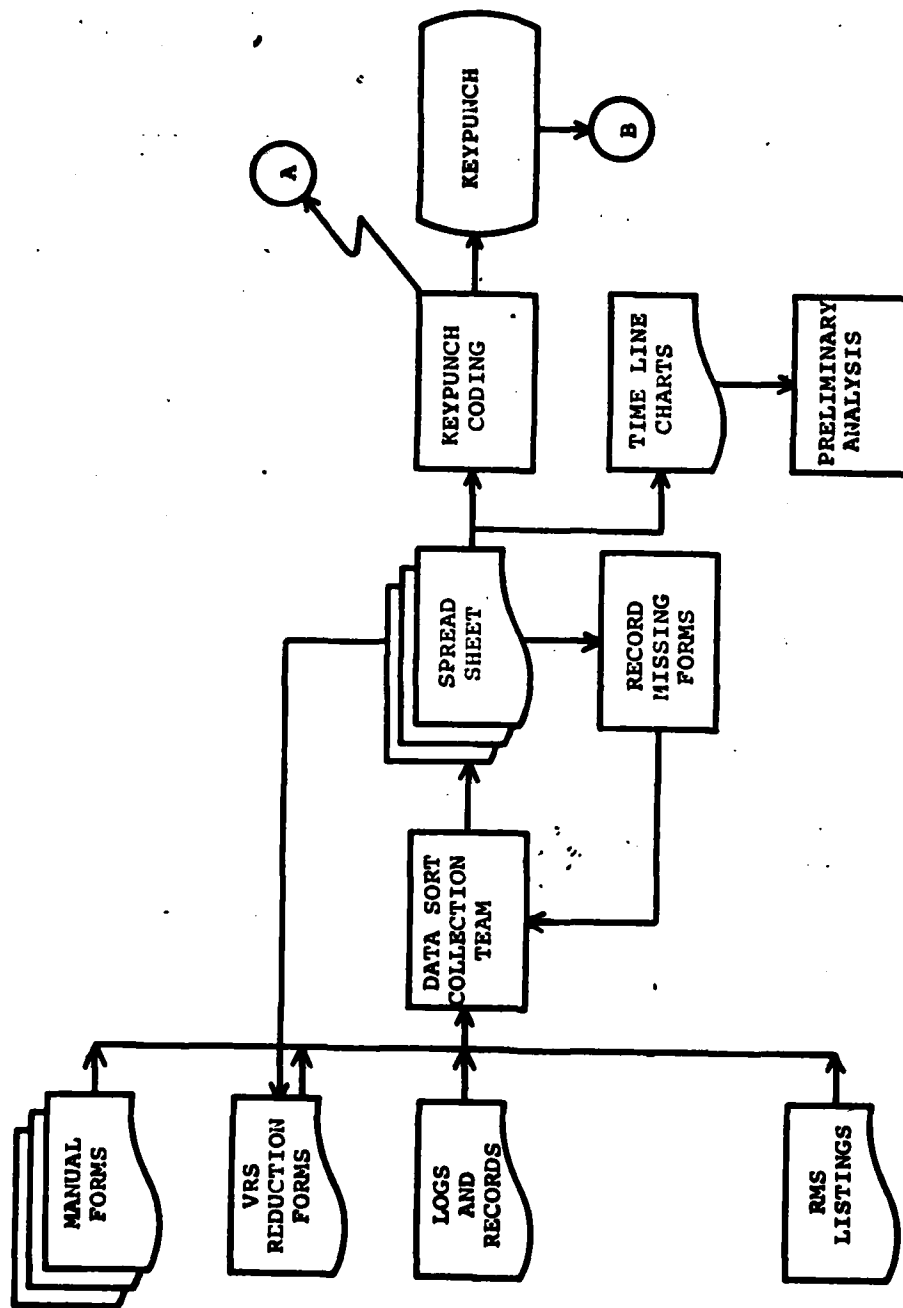
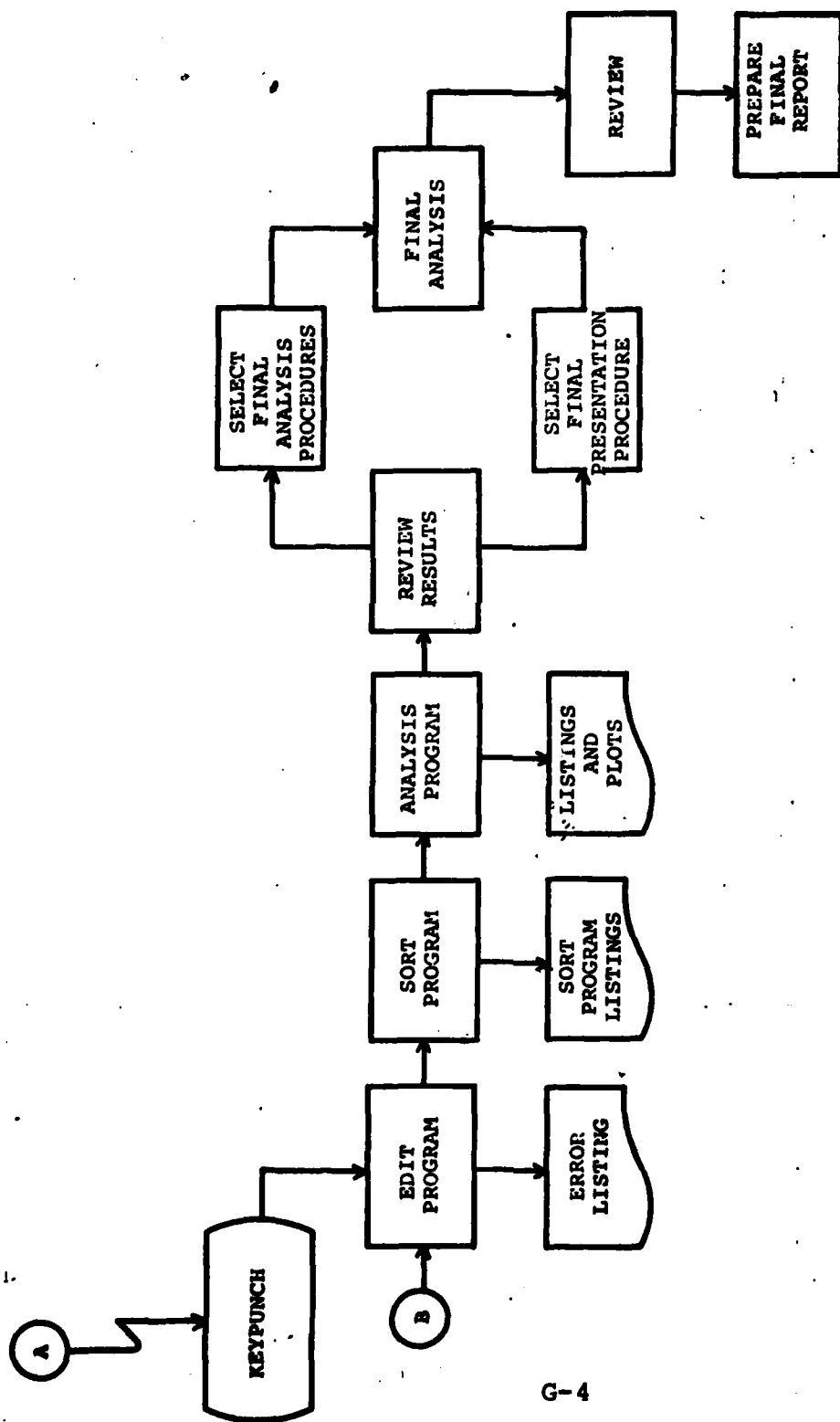


Figure G-1
Manual Data Processing



G-4

Figure G-2
Automated Data Processing

GAME FOX-SOUTH

GULFPORT - 01

CAS SPREAD SHEET

DATE 06 MAR 74 REQUEST NO. 88-0601

MISSION NO. 355-0601

TARGET UTM 839 301

3
M

BN				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
BLAN	1320			
BURASC	1321			
DASGTH	1322			

RDE (MONITOR)				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
EDGOSAI	1321			

DIV (MONITOR)				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
DIVMO	1321			

DASC MUSIC MAIL				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
BURASC	1321			
DASGTH	1322			

TUOC				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
TUDASC	1329			
TUEL	1329			
ELIU	1329			
ELARB	1331			

CRC				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
CRCFL	1331			

EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST

EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST

GFAC RM-369 MORNING STAR				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
ELATC	1333			
ELACV	1336			
ELVIG	1336			
ELAKSL	1338			
ELAKT	1340			

AIRCREW				
EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST
FLAKGN	1328			

EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST

EVENT CODE	TIME	SOURCE 1	SOURCE 2	BEST

Figure G-3. CAS Spread Sheet.

EXERCISE GAME FOR NORTH
MISSION F/M 0707-0309
TARGET UTM NY 309

CAS CODING FORM

• NIGHT ARTIFIED

MISSION DATA

DATE	REQUNT	RECONUM	C-SYST	BEGCLK	TIMEDY	WX	TOTENV	EQUAM	SECCOM	STDEQU	AIRTRM	TYP
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31												
010174	STEP 14	43	ARMY	910	0000	CLEAR	POOR	NO/DIRGN	SECR	STD NO/AIR		P1
			ARMY/A		NIGHT REDUCE		RICH	DAMAGE	SECURE	NEW AIRTRM		
			NAVY/R									
			AAW		ORDDRP	WXALT	SERVIC	WXTAVI	WXTACE	WXTGVI	WXTGCE	
			NO/AAW	ECM/ECR	LIVE		AIRFOR	0-5	500-	0-5	500-	P2
			AA/WPN	ECM/SIMULA			ARMY	5-1	1000-	5-1	1000-	
							NAVY	1-3	3000-	1-3	3000-	
							STARTING	3-5	5000-	3-5	5000-	
							OVER	5	5000-	OVER	5	5000+
			TACIT	NUMFLT	TYPAIR	TERCON	ALERTP		ORDASS	ORDONB	ALERTS	
			ATTACK	/	F-111	CLEAR	CROUND				5	P3
			DEFENC		F-4	AFAC	AIR				OTHER	
			RETROG		A-7	ASRTD	IVERT					
			SPECIA		A-37	UNK	DECK					
					AC-119		GRNFMD					
					A-6							
					CRV-B							
					F-100							
					A-4							
					AH1Q							
					AH1G							
					QTR/MX							
			TGTDES	NUMAIR	TGTMRK	TGTACO	TERRAL	UTHC00				
			PERS-O		SMOKE	ISSUAL	OPEN					P4
			PERS-C		LASER	LASERCLUTTE						
			WVVENI		ISSUAL	GRNDES						
			ARVETD		RADAR	RADAR						
			WARDEN		OTHER	OTHER						

Figure G-4
Mission Data Coding Form

TABLE G-1

<u>CODE</u>	<u>EXPLANATION</u>
DATE	Date
REQUNT	Requesting Unit
REQNUM	Request sequence number
C ² SYST	Command and Control System
BEGCLK	First Clock Time
TIMEDY	Time of day
WX	Weather
TGTENV	Target environment
EQU DAM	Equipment damage
SECCOM	Secure communications
STDEQU	Standard Equipment
AIRTHR	Air threat
AAW	Air defense threat
ECM	Electronic countermeasures
SYSINT	System interface
INTELL	Intelligence
SERVIC	Service
WXTAVI	Visibility at takeoff
WXTACE	Ceiling at takeoff
WXTGVI	Visibility at target
WXTGCE	Ceiling at target
TACSIT	Tactical situation
NUMFLT	Number of flights
TYP AIR	Type of aircraft
TERCON	Type of terminal control
ALERTP	Alert posture
ORDREQ	Ordnance required
ORDASS	Ordnance assigned
ORDONB	Ordnance onboard
ALERTS	Alert status
TGTDES	Target Description
NUMAIR	Number of aircraft
TGTMRK	Target marking method
TGTACQ	Target acquisition method
TERRAL	Target background
UTMCOO	UTM coordinates of target

CAS CODING DEFINITIONS

[illegible]

Figure G-5
Time Line Chart

UNCLASSIFIED

SUMMARY LISTINGS OF MISSION 040474STEP14 43

LISTING: 1

REQUEST ID DATE/UNT/MON	BASE CONDITION	C2SVST	SERVIC	ACTYPE	TERCON	ALERTP	ALERTS	TGTDOS	TGTNRK	TGTPAS	TGTSIT
040474STEP14 43	00202022022	NAVY/M	MARINE	AV-8	GPAC	GROUND	15	ARVHI	VISUAL	2	ATTACK
MODE	CLOCK TIME	ELAPSED TIME MIN SINCE REQUEST	ELAPSED TIME MIN SINCE START	MODE	DELAY/ABORT BY MODE						
START	EVENT										
	910	0	0								
	913	3	3								
FSCC	913	3	0								
	914	4	1								
DASC	913	3	0								
	913	3	0								
	914	4	1								
	912	2	0								
	913	3	1								
	914	4	2								
	914	4	0								
	915	5	1								
	914	4	0								
	916	6	2								
	916	6	2								
	918	8	0								
	918	8	0								
	920	10	2								
	921	11	3								
	920	10	0								

Figure G-7

Sort Printout

UNCLASSIFIED

ANNEX H

GLOSSARY

The following list consists of official doctrinal terms from JCS Pub 1, Service approved terms and terms specifically defined by the Close Air Support Joint Validation Headquarters. Non-JCS terms are identified by an asterisk (*) for ease of identification.

ABORT. Failure to accomplish a mission for any reason other than enemy action. It may occur at any point from initiation of operation to destination.

ADVERSE WEATHER. Weather in which military operations are generally restricted or impeded.

AIRBORNE ALERT. A state of aircraft readiness wherein combat equipped aircraft are airborne and ready for immediate action.

AIRCRAFT SCRAMBLING. Directing the immediate takeoff of aircraft from a ground alert condition of readiness.

AIR GROUND OPERATIONS SYSTEM. An Army/Air Force system providing the ground commander with the means for receiving, processing, and forwarding the requests of subordinate ground commanders for air support missions and for rapid dissemination of information and intelligence.

AIR LIAISON OFFICER. An officer (aviator/pilot) attached to a ground unit who functions as the primary advisor to the ground commander on air operations matters.

AIR STRIKE. An attack on specific objectives by fighter, bomber, or attack aircraft on an offensive mission. May consist of several air organizations under a single command in the air.

***AIR SUPPORT RADAR TEAM (ASRT).** A subordinate operational component of a tactical air control system which provides ground controlled precision flight path guidance and weapons release.

ALLOCATION. The designation of specific numbers and types of aircraft sorties for use during a specified time period or for carrying out an assigned task.

AMPHIBIOUS OPERATION. An attack launched from the sea by naval and landing forces, embarked in ships or craft involving a landing on a hostile shore.

ANALYSIS METHODOLOGY. Identifies the techniques for combining the data elements, augmented and clarified with qualitative data from data collectors, and subjective comments from unified commands into useful presentations.

APPORTIONMENT. A commander's decision on division of the total tactical air capability among air strike tasks to be performed for a specified period.

ARMY AIR GROUND SYSTEM. The Army system which provides for interface between Army and Tactical Air support agencies of other Services in the planning, evaluating, processing, and coordinating of air support requirements and operations. It is composed of appropriate staff members, including G-2 air and G-3 air personnel, and necessary communications equipment.

***ARMY ATTACK HELICOPTER CONTROLLER.** A company commander, squad leader, platoon leader, F.O., scout helicopter or another attack helicopter who, from a forward ground or airborne position, controls attack helicopters engaged in close air support of ground troops.

***ATTACK HELICOPTERS.** A helicopter specifically designed as an aerial weapons platform to provide direct aerial fire on enemy area and point targets, and to supplement the fires of ground-based weapons.

ATTRITION. The reduction of the effectiveness of a force caused by loss of personnel and materiel.

ATTRITION RATE. A factor, normally expressed as percentage, reflecting the degree of losses of personnel or materiel due to various causes within a specified period of time.

ARTILLERY. Complete projectile-firing weapons consisting of cannon or missile launchers on suitable carriages or mounts. Field artillery cannons are classified according to caliber as:

- light - 120mm and less
- medium - 121-160mm
- heavy - 161-210mm
- very heavy - greater than 210mm

BATTERY. Tactical and administrative artillery unit or subunit in other branches of the Army.

BEACON. A light or electronic source which emits a distinctive or characteristic signal used for the determination of bearings, courses, or location.

BINGO. (When originated by controlling activity) I have reached minimum fuel for safe return to base or to designated alternate.

BRIGADE. A unit usually smaller than a division to which are attached groups and/or battalions and small units tailored to meet anticipated requirements.

CALL MISSION. A type of air support mission which is not requested sufficiently in advance of the desired time of execution to permit detailed planning and briefing of pilots prior to takeoff. Aircraft scheduled for this type of mission are on air, ground, or carrier alert, and are armed with a prescribed load.

CHAIN OF COMMAND. The succession of commanding officers from a superior to subordinate through which command is exercised. Also called command channel.

CLOSE AIR SUPPORT. Air attack against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.

***CLOSE AIR SUPPORT WORKING GROUP.** A group assembled by the JVH, as needed, to provide operational expertise to assist in planning or review of a specific subject, to include review of all JVH CAS Validation Program draft reports. Working group membership normally will consist of personnel from USREDCOM and LANTCOM and their components, as required, and from other organizations as invited.

COMMAND. The authority which a commander in the military Service lawfully exercises over his subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions.

COMMAND AND CONTROL. The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of his mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures which are employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of his mission.

***COMPATABILITY.** Systems for tactical command and control, and communications are compatible with one another when necessary information can be exchanged at appropriate levels of command directly and in usable form. Equipment is compatible with one another if signals can be exchanged between them and if the equipment or systems being interconnected possesses comparable performance characteristics.

CONTROL. Authority which may be less than full command exercised by a commander over part of the activities of subordinate or other organization.

CONTROL AND REPORTING CENTER (CRC). An element of the United States Air Force tactical air control system, subordinate to the Tactical Air Control Center, from which radar control and warning operations are conducted within its area of responsibility.

CONTROL AND REPORTING POST (CRP). An element of the United States Air Force tactical air control system, subordinate to the control and reporting center, which provides radar control and surveillance within its area of responsibility.

COORDINATING AUTHORITY. A command or individual assigned responsibility for coordinating specific functions or activities involving forces of two or more Services, or two or more forces of the same Service. He has the authority to require consultation between the agencies involved but does not have the authority to compel agreement. In the event he is unable to obtain essential agreement, he shall refer the matter to the appointing authority.

***CRITICAL EVENTS.** The beginning or ending of a CAS function for which data is required to satisfy one or more CAS Validation Objectives.

DATA. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation or processing by human or by automatic means. Any representations such as characters or analog quantities to which meaning is or might be assigned.

DATA COLLECTION PLAN. An overall plan for collecting empirical data in the area of CAS command and control.

***DECISION TIME.** A part of the processing time. In many cases decision time will not be a definite singular time, but integrated into processing time. In those cases where decision time can be identified, times will be collected.

***DELAY.** An event that increases the length of time required to perform a function or process.

***DESCRIPTIVE EVENTS MODEL.** A schematic representation of the sequence of events descriptive of an immediate CAS mission.

***DETAILED ANALYSIS PLAN.** The Validation Headquarters document that specifies in detail the interrelations of the validation objectives and the requirement for the collection, analysis and presentation of findings for the CAS validation effort.

***DETAILED INDIVIDUAL TEST PLAN (DITP).** A specific test plan which provides details of each exercise. This plan will be promulgated by the sponsoring command or Service not later than 60 days prior to implementation.

***DETAILED TEST PLAN.** A JCS approved plan outlining procedures and methodologies for conduct of the Close Air Support Validation Plan.

DIRECT AIR SUPPORT CENTER (DASC). A subordinate operational component of a tactical air control system designed for control and direction of close air support and other tactical air support operations and is normally collocated with fire support coordination elements.

DIRECT SUPPORT ARTILLERY. Artillery whose primary task is to provide fire as requested by the supported unit.

DIRECT SUPPORT FIRE. Fire delivered in support of part of a force, as opposed to general supporting fire which is delivered in support of the force as a whole.

DIVERT. To change the target, mission, or destination of an aircraft.

DIVISION. A tactical unit/formation as follows: A major administrative and tactical unit/formation which combines in itself the necessary arms and services required for sustained combat, larger than a regiment/brigade and smaller than a corps.

DIVISION ARTILLERY. Artillery that is permanently an integral part of a division. For tactical purposes, all artillery placed under the command of a division commander is considered division artillery.

DIRECT FIRE. Gunfire delivered on a target, using the target itself as a point of aim for either the gun or the director.

DIRECT SUPPORT. A mission requiring a force to support another specific force and authorizing it to answer directly the supported force's request for assistance.

ECHELON. A fraction of a command in the direction of depth, i.e., attack echelon, support echelon, reserve echelon.

ELECTRONIC COUNTERMEASURES (ECM). That division of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum. Electronic countermeasures include electronic jamming and electronic deception.

***ENVIRONMENTAL CONDITIONS.** Factors used in the CAS Validation Program to describe terrain and weather conditions.

***EXECUTION PHASE.** A phase of a CAS mission which commences with acknowledgment of flight leader to launch or execute and terminates with first weapons release on target.

***EXTERNAL REFERENCE SYSTEM.** A system by which a target or reference point is indicated to the attack aircraft and which has at least one component which is not a part of the aircraft avionics.

FIELD ARTILLERY DIRECT SUPPORT WEAPONS. Artillery assigned the task of executing the fire requested by the supported unit.

FIELD ARTILLERY GENERAL SUPPORT WEAPONS. Artillery which fires in support of the operation as a whole rather than a specific unit.

FIELD ARTILLERY OBSERVER. A person who watches the effects of artillery fire, adjusts the center of impact of that fire onto a target, reporting results to the firing agency.

FIELD EXERCISE. An exercise conducted in the field under simulated war conditions in which troops and armament of one side are actually present, while those of the other side may be imaginary or in outline.

FIRE DIRECTION CENTER. That element of a command post, consisting of gunnery and communication personnel and equipment, by means of which the commander exercises fire direction and/or fire control. The fire direction center receives target intelligence and requests for fire, and translates them into appropriate fire direction.

FIRE MISSION. Specific assignment given to a fire unit as part of a definite plan. Order used to alert the weapon/battery area and indicate that the message following is a call for fire.

FIRE SUPPORT COORDINATION. The planning and executing of fire so that targets are adequately covered by a suitable weapon or group of weapons.

FIRE SUPPORT COORDINATION CENTER. A single location in which are centralized communications facilities and personnel incident to the coordination of all forms of fire support.

FIRE SUPPORT COORDINATION LINE. An imaginary line arranged, if feasible, to follow well defined geographical features, prescribed by the troop commander and coordinated with appropriate supporting commanders, forward of which supporting forces may attack targets, without danger or reference to the ground forces. Behind this line the attack of targets by forces are not under the control of the troop commander.

FORWARD AIR CONTROLLER. An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, controls aircraft engaged in close air support of ground troops.

FORWARD AIR CONTROL POST. A highly mobile United States Air Force tactical air control system radar facility subordinate to the control and reporting center and/or post used to extend radar coverage and control in the forward combat area.

FORWARD OBSERVER. An observer operating with front line troops and trained to adjust ground or naval gunfire and pass back battlefield information. In the absence of a forward air controller he may control close air support strikes.

FRAGMENTARY ORDER. An abbreviated form of an operation order, usually issued on a day-to-day basis which eliminates the need for restating information contained in a basic operations order. It may be issued in sections.

GENERAL SUPPORTING ARTILLERY. Artillery which execute the fire directed by the commander of the unit to which it organically belongs or is attached. It fires in support of the operation as a whole rather than in support of a specific unit.

GENERAL SUPPORT-REINFORCING. A tactical artillery mission. General support-reinforcing artillery has the mission of supporting the force as a whole and of providing reinforcing fires for another artillery unit.

GROUND ALERT. That status in which aircraft on the ground/deck are fully serviced and armed, with combat crews in readiness to take off within a specified short period of time after receipt of a mission order.

IMMEDIATE AIR SUPPORT. Air support to meet specific requests which arise during the course of a battle and which by their nature cannot be planned in advance.

IMMEDIATE MISSION REQUEST. A request for an air strike on a target which by its nature could not be identified sufficiently in advance to permit detailed mission coordination and planning.

INTELLIGENCE. The product resulting from the collection, evaluation, analysis, integration, and interpretation of all information concerning one or more aspects of foreign countries or areas, which is immediately or potentially significant to the development and execution of plans, policies and operations.

INTERCHANGEABILITY. A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves or of the adjoining items, except for adjustment, and without selection of fit and performance.

***INTEROPERABILITY.** Used to denote when automated tactical data systems are capable of exchanging data in a prescribed format and frequency and with mutual non-interference; and processing such data through individual hardware/software and procedures configurations to extract intelligence information which is identical or differs only by an established set of constraints.

***JOINT VALIDATION HEADQUARTERS (JVH).** The JVH is a standing USREDCOM/LANTCOM joint headquarters formed to plan, coordinate, control and report on all aspects of the Joint Chiefs of Staff directed validation of the CAS Phase II Study results. It is under the direct administrative and operational control of the Joint Program Director who is concurrently assigned as Director, J5 (Plans and Policy), USREDCOM. The Program Director is responsible to USCINCPAC, in coordination with CINCLANT, for all aspects of the CAS Validation Program. The USREDCOM J5-C Division comprises the nucleus of the JVH, with LANTCOM providing personnel TDY as necessary. The JVH is located at USREDCOM Headquarters, MacDill AFB, Florida.

***LASER DESIGNATOR.** A device capable of marking a target with a laser spot.

***LASER SEEKER.** An acquisition system capable of detecting a laser spot. May be used to locate and identify a specific position, object or target in preparation for, or as an aid to, an attack by close air support aircraft; to differentiate friend from foe; to serve as a means of communications between a controller and a close air support aircraft; or to serve as an aid to delivery of a laser guided weapon.

***LASER TARGET DESIGNATION SYSTEM (LTDS).** A cooperative system of laser designator and laser seeker.

LEAD AIRCRAFT. The airborne aircraft designated to exercise command of other aircraft within the flight.

***LINK TIMES.** The time for acknowledgement of receipt of a message at one command and control element to the time the follow-on message is acknowledged at a following command and control element.

MARGINAL WEATHER. Weather which is sufficiently adverse to a military operation so as to require the imposition of procedural limitations.

MARINE AIR COMMAND AND CONTROL SYSTEM. A United States Marine Corps tactical air command and control system which provides the tactical air commander with the means to command, coordinate, and control all air operations within an assigned sector and to coordinate air operations with other Services. It is composed of command and control agencies with communication-electronic equipment that incorporates a capability from manual through semiautomatic control.

MARINE AIR CONTROL SQUADRON. The component of the Marine Air Control Groups which provides and operates ground facilities for the detection and interception of hostile aircraft and for the navigational direction of friendly aircraft in the conduct of support missions.

***MEASURES OF ANALYSIS.** Quantitative measures employed in the CAS Validation Program used to assess the performance of the three networks for command and control of CAS.

***MEASURE OF EFFECTIVENESS.** Measure for assessing the performance of the three command and control networks for CAS.

***MISSION RESPONSE TIME.** Time interval from acknowledgement of CAS request by first element of the command and control system to first weapons release on target. (Request plus Execution Phase).

***NODE.** An element or agency in a command and control system where requirement is originated, processed for onward movement, or terminated.

***NODE-TO-NODE LINK TIMES.** The summation of the node processing time and the node-to-node communication time to the next node.

ON CALL. The term used to signify that a prearranged concentration, air strike, or final protective fire may be called for.

***OPERATIONAL CONDITIONS.** Factors used to describe the scope and nature of the tactical situation, e.g., offense.

PASS. A short tactical run or dive by an aircraft at a target; a single sweep through or within firing range of an enemy air formation.

***PATTERN OF ANALYSIS.** A logical division of the overall CAS Validation Objectives into subobjectives and further subdivisions, subelements (sometimes referred to as a logic diagram or dendritic diagram). The mechanism for translating broad objectives into distinct, manageable elements for evaluation.

PREPLANNED AIR SUPPORT. Air support in accordance with a program planned in advance of operations.

PREPLANNED MISSION REQUEST. A request for an air strike on a target which can be anticipated sufficiently in advance to permit detailed mission coordination and planning.

***PROCESSING TIME.** The incremental time between the time of first attempt to transmit the request to the next node and the time of acknowledgement of the request at the present node.

***QUALITATIVE DATA.** Those remarks which the data collector records concerning system/element performance. These will take the form of causes, delays, aborts, disapprovals, cancellations, general remarks, and an assessment of the manner in which network elements or agencies perform CAS functions.

***QUANTITATIVE DATA.** The various times events occur and other numerical data, such as numbers of aircraft, requests, missions, targets, etc.

RADAR BEACON. A receiver-transmitter combination which sends out a coded signal when triggered by the proper type of pulse, enabling determination of range and bearing information by the interrogating station or aircraft.

***RANGE MEASURING SYSTEM (RMS-2).** A system that collects data from which three-dimensional position as a function of time can be calculated for transponder-instrumented aircraft and ground vehicles.

***REFERENCE POINT.** A prominent, easily located point from which the location of a target may be indicated in terms of distance and direction. The reference point may be a terrain feature, air or ground delivered marking munitions, or other recognizable indicators.

REACTION TIME. The elapsed time between the initiation of an action and the required response. The time required between the receipt of an order directing an operation and the arrival of the initial element of the force concerned in the designated area.

REPORTING POST. An element of the control and reporting system used to extend the radar coverage of the control and reporting center. It does not undertake the control of aircraft.

***REQUEST PHASE.** A phase of a CAS mission which commences with the acknowledgement of a CAS request by the first element of the command and control system and terminating with acknowledgment by the flight leader/pilot to launch or execute.

SCRAMBLE. Takeoff as quickly as possible (usually followed by course and altitude instructions).

***SHORT AIRFIELD FOR TACTICAL SUPPORT (SATS)** A shore based system which provides essentially the same facilities for the launch and recovery of tactical aircraft as the deck of an aircraft carrier.

SORTIE. An operational flight by one aircraft.

***SUBJECTIVE COMMENTS.** Expository comments from Services and appropriate unified commands, to include their components, made for the purpose of augmenting and clarifying Empirical data (ANNEX B).

STRIKE. An attack which is intended to inflict damage on, seize or destroy an objective.

STRIKE FORCE. A force composed of appropriate units necessary to conduct strike, attack or assault operations.

SUPPORTING ARMS COORDINATION CENTER. A single location on board an amphibious command ship in which all communication facilities incident to the coordination of fire support of the artillery, air, and naval gunfire are centralized. This is the naval counterpart to the fire support coordination center utilized by the landing force.

TACTICAL AIR COMMAND CENTER. The principal United States Marine Corps air operation installation from which aircraft and air warning functions of tactical air operations are directed. It is the senior agency of the Marine Corps Air Command and Control System from which the Marine Corps tactical air commander can direct and control tactical air operations and coordinate such air operations with other Services.

TACTICAL AIR COMMANDER (ASHORE). The officer (aviator) responsible to the landing force commander for control and coordination of air operations within the landing force commander's area of responsibility when control of these operations is passed ashore.

TACTICAL AIR CONTROL CENTER. The principal air operations installation (land or ship-based) from which all aircraft and air warning functions of tactical air operations are controlled.

TACTICAL AIR CONTROL GROUP. (Land-Based) A flexible administrative and tactical component of a tactical air organization which provides aircraft control and warning functions ashore for offensive and defensive missions within the tactical air zone of responsibility. (Ship-Based) An administrative and tactical component of an amphibious force which provides aircraft control and warning facilities afloat for offensive and defensive missions within the tactical air command area of responsibility.

TACTICAL AIR CONTROLLER. The officer in charge of all operations of the tactical air control center (afloat). He is responsible to the tactical air officer for the control of all aircraft and air warning facilities within his area of responsibility. See also air controller.

TACTICAL AIR CONTROL PARTY. A subordinate operational component of a tactical air control system designed to provide air liaison to land forces and for the control of aircraft.

TACTICAL AIR OPERATIONS CENTER. A subordinate operational component of the Marine Air Command and Control System designed for direction and control of all en route air traffic and air defense operations, to include manned

interceptors and surface-to-air weapons, in an assigned sector. It is under the operational control of the Tactical Air Command Center.

TACTICAL AIR SUPPORT ELEMENT. An element of a United States Army division, corps, or field army tactical operations center consisting of G-2 and G-3 air personnel who coordinate and integrate tactical air support with current tactical ground operations.

TACTICAL AIR CONTROL SYSTEM. The organization and equipment necessary to plan, direct, and control tactical air operations and to coordinate air operations with other Services. It is composed of control agencies and communications-electronics facilities which provide the means for centralized control and decentralized execution of missions.

TACTICAL AIR COORDINATOR (AIRBORNE). An officer who coordinates, from an aircraft, the action of combat aircraft engaged in close support of ground or sea forces.

TACTICAL AIR DIRECTION CENTER. An air operations installation under the overall control of the tactical air control center (afloat)/tactical air command center, from which aircraft and air warning service functions of tactical air operations in an area of responsibility are directed.

TACTICAL AIR DIRECTOR. The officer in charge of all operations of the tactical air direction center. He is responsible to the tactical air controller for the direction of all aircraft and air warning facilities assigned to his area of responsibility. When operating independently of a tactical air control center (afloat), the tactical air director assumes the functions of the tactical air controller. See also tactical air direction center.

TACTICAL AIR FORCE. An air force charged with carrying out tactical air operations in coordination with ground or naval forces.

TACTICAL AIR OBSERVER. An officer trained as an air observer whose function is to observe from airborne aircraft and report on movement and disposition of friendly and enemy forces, on terrain, weather, and hydrography and to execute other missions as directed.

TACTICAL AIR OFFICER (AFLOAT). The officer (aviator) under the amphibious task force commander who coordinates planning of all phases of air participation of the amphibious operation and air operations of supporting forces en route to and in the objective area. Until control is passed ashore, he exercises control over all operations of the tactical air control center (afloat) and is charged with: (a) control of all aircraft in the objective area assigned for tactical air operations, including offensive and defensive air; (b) control of all other aircraft entering or passing through the objective area; and (c) control of all air warning facilities in the objective area.

TACTICAL OPERATIONS CENTER (TOC). A physical groupment of those elements of an Army general and special staff concerned with current tactical operations and the tactical support thereof.

***TACTICAL UNIT OPERATIONS CENTER (TUOC).** The operations focal point of the tactical unit headquarters. Through the TUOC, the unit commander receives operations orders and combat plans from higher headquarters, controls resources and directs unit operations. Communications are provided for rapid coordination with appropriate elements of the Tactical Air Control System (TACS).

TARGET. A geographical area, complex, or installation planned for capture or destruction by military forces. In intelligence usage, a country, area, installation, agency, or person against which intelligence operations are directed. An area designated and numbered for future firing. In gunfire support usage, an impact burst which hits the target.

TARGET ACQUISITION. The detection, identification, and location of a target in sufficient detail to permit the effective employment of weapons.

***TARGET AREA.** For the purpose of the CAS Validation Program, that portion of the battlefield wherein close air support attacks are conducted.

***TEST DESIGN.** Specifies the range of exercise conditions (operational and environmental) to be incorporated in scenarios, the number of CAS missions required, and the paths of the three command and control networks for CAS of primary interest for purposes of analysis. The test design, in effect, establishes and limits the scope of quantitative analysis.

***UNCONTROLLED FACTORS.** Refers to data, descriptive of the performance of the three command and control networks for CAS. These include: immediate CAS mission performance data, network path utilized, CAS mission variables, and techniques and procedures.

UNIT. Any military element whose structure is prescribed by competent authority, such as a table of organization and equipment; specifically, part of an organization. An organizational title of a subdivision of a group in a task force.

***VERTICAL AND/OR SHORT TAKEOFF AND LANDING AIRCRAFT (V/STOL).** A fixed wing aircraft that is specifically designed to operate in the vertical mode or alternately to utilize short distances for takeoff and landing in comparison to a conventional aircraft.

***VOICE RECORDING SYSTEM (VRS).** A system designed to record communications over each of several radio/wire channels. The recordings are made on multi-channel magnetic tape and are accompanied by a synchronous time signal code.

APPENDIX 1

ACRONYMS

AAW	Anti-Air Warfare
AFA	Aerial Field Artillery
AFRED	Air Forces Readiness Command
AH	Attack Helicopter
ALO	Air Liaison Officer
AOA	Amphibious Objective Area
ARRED	Army Forces Readiness Command
ASRT	Air Support Radar Team
ATF	Amphibious Task Force Command
ATFC	Amphibious Task Force Commander
BDM	Braddock, Dunn, McDonald, Inc.
CAP	Combat Air Patrol
CAS	Close Air Support
CP	Command Post
CRC	Combat Reporting Center
CRP	Combat Reporting Post
CTOC	Corp Tactical Operations Center
DAP	Detailed Analysis Plan
DASC	Direct Air Support Center
DCP	Data Collection Plan
DDR&E	Director of Defense Research and Engineering
DITP	Detailed Individual Test Plan
DS	Direct Support
DTOC	Division Tactical Operations Center
DTP	Detailed Test Plan
ECM	Electronic Countermeasures
FAA	Federal Aviation Administration
FAC(A)	Forward Air Controller(Airborne)
FAC(G)	Forward Air Controller (Ground)
FACP	Forward Air Control Party
FDC	Fire Direction Center

FEBDA	Forward Edge of the Battle Area
FO	Forward Observer (Artillery)
FRAG	Fragmentary Order
FSCC	Fire Support Coordination Center
FSO	Fire Support Officer
GCA	Ground Control Approach
JCS	Joint Chiefs of Staff
JVH	Joint Validation Headquarters
LANTCOM	Atlantic Command
LFC	Landing Force Commander
MAG	Marine Air Group
MATCU	Marine Air Traffic Control Unit
OPCON	Operational Control
RABFAC	Radar Beacon Forward Air Controller
RMS-2	Range Measuring System
SAC	Supporting Arms Coordinator
SACC	Supporting Arms Coordination Center
TAC(A)	Tactical Air Coordinator (Airborne)
TACC	Tactical Air Control Center (Air Force)
TACC	Tactical Air Control Center (Afloat) (Navy)
TACC	Tactical Air Control Center (Ashore) (Marine Corps)
TADC	Tactical Air Direction Center
TADC(A)	Tactical Air Direction Center (Afloat)
TACP	Tactical Air Control Party
TAFC	Tactical Air Force Commander
TAOC	Tactical Air Operations Center
TAR	Tactical Air Request
TOC	Tactical Operations Center
TPC	Test Plan Concept
TUOC	Tactical Unit Operations Center
USEUCOM	United States European Command
USREDCOM	United States Readiness Command
VRS	Voice Recording System
WSEG	Weapons Systems Evaluation Group

ANNEX I
DISTRIBUTION

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DDPA&E	(5)
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DIR DCA	
DIR NSA/CH CSS	
CINCAL	5
USCINCEUR	25
CINCPAC	5
USCINCSO	5
CINCLANT	50
CINCLANTFLT	
CGFMFLANT	
COMPHIBLANT	
COMNAVAIRLANT	
WESEG	10
USCINCARRED (AFOR)	10
USCINCAFRED (XPDT)	15
HQ MASSTER	5
CDRTRADOC	5
USCINCRED	100
J1 (2)	
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